meinertzhageni Thomas). The photograph (text-fig. 39) had been taken by Mr. T. J. Morson, of Limoru, who had obtained the pigs in the Limoru escarpment forest about 353 miles from Mombasa, at an elevation of between seven and eight thousand feet.

The Secretary stated that he had been informed by the High Commissioner for New Zealand, that the Chamois presented by the Emperor of Austria to New Zealand, and which had been successfully taken to New Zealand by one of the Society's staff in the beginning of 1907, had been seen in the locality in which they were liberated, one of the females being accompanied by a strong, healthy-looking kid.

The following papers were read :—

1. A Monograph of the Chiropteran Genera *Uroderma*, *Enchisthenes*, and *Artibeus*. By Knud Andersen.

[Received May 29, 1907.]

(Text-figures 40–59.)

Contents.

The conclusions recorded in this paper are based on a study of 485 Bats (361 skulls) of the genera *Uroderma*, *Enchisthenes*, and

*Artibeus**. 272 of these specimens (218 skulls) form part of the collections of the British Museum; the rest, 213 specimens (143 skulls), were placed at my disposal, for inspection and identification, by the Authorities of the United States National Museum.

The British Museum series is particularly rich in South and Central American, the Washington series in Mexican and West Indian specimens. Thus the two collections admirably supplement each other.

I wish to tender my grateful thanks to Mr. Oldfield Thomas for the opportunities he has so kindly afforded me for continuing my Chiropteran studies in the British Museum. To Dr. J. Leisewitz, Munich, Dr. Marcus W. Lyon, Washington, and Professor D. G. Elliot, Chicago, I am indebted for information on typical specimens in the collections under their charge.

The Dentition of *Artibeus planirostris*.

The teeth of one species only, viz., *Artibeus planirostris* (subsp. *fallax*) are described in detail in this paper, the description of the dentition in the other forms being, as a rule, confined to those points in which it differs from this paradigma.

On the denomination of the molar cusps.—The molar cusps are named in accordance with Herluf Winge's theory †. The three cusps (labial in the upper, lingual in the lower jaw) forming the tips of the **W** of a typical molar in insectivorous bats are termed, in antero-posterior direction, respectively 1, 2, 3, cusp 2 being probably the oldest, homologous with the single cusp of a Reptilian tooth; the two cusps forming the bases of the **W** are named 4 and 5; the "heel" of the upper molars, when single, cusp 6, when double, cusps 6 and 7. See text-figs. 40, 41, pp. 207, 208.

Tooth formula.—$\frac{i^1\ i^2 — c — — p^3\ p^4\ m^1\ m^2\ m^3}{i_1\ i_2 — c\ p_1 — — p_4\ m_1\ m_2\ m_3}$.

Remarks on the tooth formula.—No known bat has more than two pairs of upper incisors. The generally accepted hypothesis is that the permanently missing pair is i^1; but, in my opinion, the balance of evidence is decidedly in favour of the view that i^3, not i^1, has been lost. The former hypothesis (i^1 lost) is generally supported by two arguments, viz., "by the correspondence of the two upper teeth with the two outer of the lower jaw when the maximum set is present," and "even more strongly by the general tendency throughout the group [*i. e.*, the Chiroptera] for the premaxillaries to become reduced, particularly along the inner edge" ‡. As to the former argument, it proves

* Brief preliminary diagnoses of the genus *Enchisthenes* and ten new forms of *Artibeus* and *Uroderma* were published in the Ann. & Mag. Nat. Hist. for December 1906 (pp. 419–423).

† Herluf Winge, Om Pattedyrenes Tandskifte, især med Hensyn til Tændernes Former (Vidensk. Meddel. Naturhist. Foren. Kjøbenhavn for 1882, pp. 15–69, pl. iii.).

‡ Gerrit S. Miller, Jr., 'The Families and Genera of Bats,' p. 27 (1907).

nothing or, if preferred, anything; attempts to determine the homologies of teeth in Mammalia on the basis of the correspondence of the upper with the lower teeth, or *vice versa*, would in too many cases lead to obviously absurd results. As to the latter argument, it seems to me, on closer examination, to lead to precisely the opposite conclusion. The tendency for the premaxillaries to become reduced along their inner edge is first developed in the higher of the two suborders of Bats, the Microchiroptera; in the Megachiroptera no such tendency obtains, and nevertheless they have only two pairs of upper incisors. When, therefore, one pair has been lost also in those primitive bats in which the premaxillaries have not been reduced along their inner edge, the loss of this pair must evidently be due to some other reason. The strong lower canines in bats (or rather their ancestors) have probably effected the degeneration, and ultimate disappearance, of that pair of upper incisors which, if it were present (or present in its full size), would hinder their free passage in front of the upper canines; in other words, in passing in front of the upper canines the lower canines have checked the growth, and ultimately caused the complete disappearance, of i^3. In accordance with this we find in most Megachiroptera the four upper incisors (i^2 i^1 i^1 i^2) close together, but i^2 separated by a wide diastema from the canine; part of this diastema indicates the former place of i^3, but it has no doubt been widened to allow of the free action of the lower against the upper canines. In many genera of Microchiroptera, this line of development has been carried a step further; by a narrowing of the diastema between i^2 and c the former has come closer to the latter and within reach of the lower canines, which then cause a decrease in size (and change in shape) of i^2. This is the case in the three genera which form the subject of the present paper, and which, therefore, in showing what actually *takes* place, in living bats, with regard to i^2, give, so to say, an illustration of what *has* probably taken place, in the ancestors of bats, with regard to the now permanently lost i^3.

A large number of Chiropteran genera (some 60 out of the now recognised 173 genera) have three pairs of lower incisors; in most of these genera the lower incisors are subequal in size; in those few in which one pair is noticeably, or even considerably, reduced, this pair is i_3 (compare f. i. *Rhogeessa*, *Bœodon*, some species of *Nyctinomus*, *Mormopterus*). From this it appears safe to assume that in bats which have only two pairs of lower incisors, the missing pair is i_3.

No bat has more than three premolars, above and below. As recently pointed out by Oldfield Thomas* the permanently missing upper and lower premolar is in all probability p^2 and p_2 (not, as hitherto taken for granted, p^1 and p_1).

In those Phyllostomatidæ which have three upper premolars

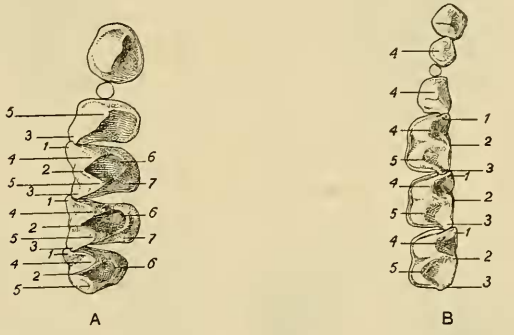
* Oldfield Thomas, "The Missing Premolar of Chiroptera," Ann. & Mag. N. H. (8) i. pp. 346–348 (April, 1908).

(*Lonchoglossa* f. i.) p^1 is the smallest. From this it is concluded that the upper premolar lost in Stenodermatous bats is p^1 (not, as in Rhinolophidæ, p^3).

p_3, if present in Phyllostomatidæ, is generally smaller than p_1 and p_4 (compare f. i. *Micronycteris*). From this it is concluded that the lower premolar lost in Stenodermatous bats is p_3, not p_1.

Upper incisors (text-figs. 41 A, D).—Inner pair bifid, the two cusps subequal in length (the inner one generally a trifle longer); front face plane or faintly convex, with slightly wrinkled enamel; hinder face strongly concave in direction from above downwards, the lower half of the crown of the tooth therefore somewhat chisel-shaped. Outer pair as broad as inner pair, but much shorter; cutting-edge simple (not bifid), oblique; front face as well as hinder face concave from side to side. The reason why the outer is considerably shorter than the inner incisor, and its cutting-edge

Text-fig. 40.



Rhinolophus trifoliatus, ♀ ad. Singapore. B.M. 4.8.23.1.

A. Right upper, B. Left lower tooth-row, exclusive of incisors; as a paradigma of structure of molars in insectivorous bats, for comparison with dentition of *Artibeus*, text-fig. 41. × 4.

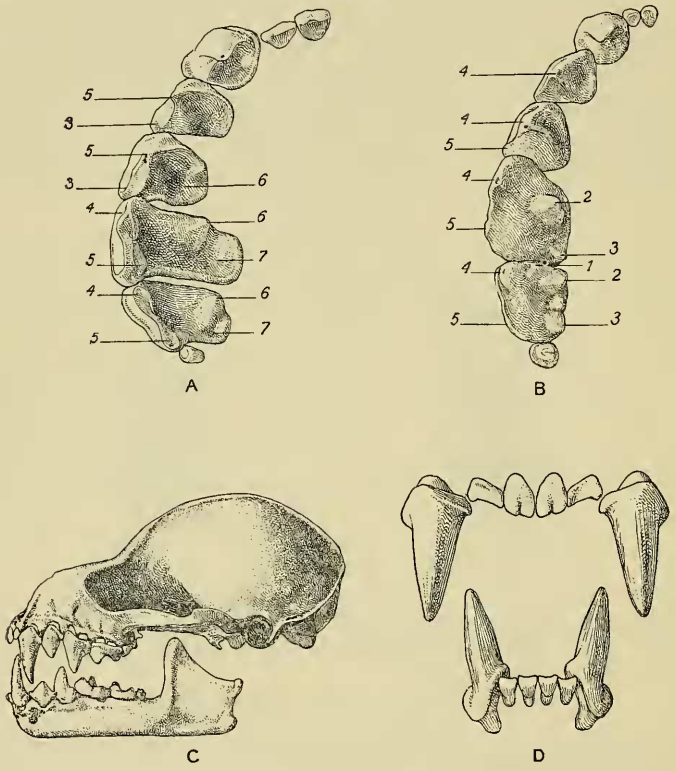
For explanation of lettering of cusps (1, 2, 3, 4, 5, 6, 7) see text, p. 205.

differently shaped, will be readily understood when studying the way in which the lower work against the upper teeth:—the long and very strong lower canines pass in front of the outer upper incisors, completely covering their front face, with exception of their narrow inner margin (text-fig. 41 D); this circumstance it is which has effected a decrease in the size of the outer incisors, made their front face concave (by constant wear against the tips of the lower canines), and the inner tip of the cutting-edge (next to inner incisors), which is less exposed to the pressure of the lower canine, longer than the outer tip of the cutting-edge (next to the upper canines), which is most exposed to the pressure of the lower canine.

Lower incisors (text-figs. 41 B, D).—All four teeth subequal in

breadth and height (the outer pair, if anything, faintly shorter); antero-posterior diameter of crown much greater than transverse diameter; front face slightly concave from side to side, as is also the cutting-edge; this latter circumstance gives the teeth in front view a slight indication of a bifid shape.

Text-fig. 41.



Artibeus planirostris fallax, ♀ ad. Kanuku Mts., British Guiana. B.M. 1.6.4.60.

A. Right upper, B. Left lower tooth-row; C. Side view of skull and mandible; D. Front view of incisors and canines. A, B, D × $\frac{4}{1}$, C × $\frac{3}{2}$.

For explanation of lettering of cusps (1, 2, 3, 4, 5, 6, 7) see text, p. 205.

Upper canines (text-figs. 41 A, D).—Very long; cingulum low, terminating abruptly in front and behind, but not developing distinct secondary cusps; on the lingual face of the canine the cingulum is somewhat expanded, forming a noticeable shelf-like projection; against this expansion of the cingulum works the principal cusp (cusp 4) of the lower p_1. Hinder margin of canine

sharp, inner margin (next to incisors) rounded, lingual face almost plane. It is the constant rubbing of the labial face of p_1 against the lingual face of the upper canine which has made this latter sharp on its hinder margin and almost plane on its lingual face.

Lower canines (text-figs. 41 B, D).—Very long; on the inner margin of the tooth, next to the incisors, the cingulum extends only as high as (or very little higher than) the level of the cutting-edges of the incisors, and does not form a secondary cusp (compare *Uroderma*); at the base of the hinder margin the cingulum forms a conspicuous shelf-like projection, caused by the constant working of the tip of the upper canine against this part of the cingulum of the lower canine.

p^3 (text-figs. 41 A, C).—Cusps 1 and 2 are entirely wanting. Cusp 3 is represented by a small (but quite distinct), backwardly projecting prominence at the postero-external base of the tooth. Cusp 4 has disappeared. The principal cusp—large, trenchant, raised to about half the height of the canine, very obliquely triangular, its front margin only about half the length of its hinder margin—is cusp 5. The size and shape of this cusp are correlated to the large, very obliquely triangular interspace between the principal cusp (4) of p_1 and p_4; its front margin is precisely of the same length as the hinder margin of cusp 4 of p_1, against which it works, and its hinder margin is of the same length as the front margin of cusp 4 of p_4, against which it works.—The tip of the powerful cusp 4 of the lower p_4 working against the lingual cingulum of p^3 has caused this latter to develop a rather strong, somewhat concave projection ("heel," representing cusp 6); also in the unworn p^3 the deep, pit-like depression caused by the tip of cusp 4 of p_4 is very noticeable. The anterior margin of the heel of p^3 is high, prominent, sharp, acting against the trenchant hinder margin of cusp 4 of p_1.

p^4 (text-figs. 41 A, C).—Longer at base, much higher and broader (transversally) than p^3, but in many important details of its structure formed after a similar pattern, though on the whole less reduced in size. Cusps 1 and 2 entirely wanting (as in p^3). Cusp 3, rather less reduced than in p^3, is represented by a low trenchant margin at the postero-external extremity of p^4. Cusp 4 (wanting in p^3) is present as a mere rudiment at the anterior extremity of the tooth. The principal cusp—still more powerful than in p^3, the highest cusp in the upper postcanine series, trenchant, with the outline of an equilateral triangle—is cusp 5; its shape is remarkably like that of cusp 4 of p_4, against the hinder margin of which it works; the strong antero-external cusp (cusp 4) of m_1 acting upon the lingual face of cusp 5 of p^4 has made this latter somewhat concave in antero-posterior direction.—The whole anterior portion of m_1 (its cusp 4 and the rudiment of cusp 1, when this latter has not completely disappeared) acting upon the lingual cingulum of p^4 has caused this latter to develop a "heel" (cusp 6), broader and a little more complicated than in p^3; the heel is broader, because it is acted upon by the broad anterior portion of m_1,

whereas in p^3 the heel is acted upon only by the pointed cusp 4 of p_4; the tip of cusp 4 of m_1 has made a deep, pit-like impression on the heel of p^4, just at the median point of the labial base of cusp 5; also the high, slender, coniform cusp 2 of m_1 rubs against the heel of p^4, viz., against its postero-internal margin, which by this pressure is kept low and rapidly worn somewhat concave. The anterior margin of the heel of p^4 is, like the corresponding margin of p^3, rather high, prominent, and sharp, for a similar reason: it fits into and works against the trenchant commissure between cusps 4 and 5 of the lower p_4; on the antero-internal margin of the heel of p^4 is seen a small, but quite distinct, triangular, rather blunt cusp, produced by the small cusp 5 (and its commissure with cusp 4) of the lower p_4 which catches and works against it on its labial side.

p_1 (text-figs. 41 B, C).—Small, "diamond"-shaped, slightly longer than high. The size and shape of its principal cusp (cusp 4) are correlated to the size and shape of the triangular interspace between the tip of p^3 and the upper canine; cusp 4 and a rudimentary cusp at the front end of the tooth (probably representing cusp 1) work against the lingual face and cingulum of the upper canine and the front margin of cusp 5 of p^3. The hinder margin of cusp 4 (together with a small, pointed, straightly backwardly extending prominence of the posterior margin of its base, perhaps representing cusp 5) work against the projecting anterior margin of the heel of p^3. The lingual cingulum of p_1 is slightly expanded.

p_4 (text-figs. 41 B, C).—Viewed from the external side rather closely resembling the upper p^4 in shape and size. Cusp 4 is large, triangular, equilateral, by far the highest cusp in the post-canine series; it works against the lingual face and posterior margin of cusp 5 of p^3, the front margin of cusp 5 of p^4, and the heel of p^3, on which its tip has produced a deep depression. A triangular emargination of the commissure between cusp 4 and the rudimentary cusp 5 (this latter situated at the postero-external corner of the tooth) has been produced by the elevated anterior margin of the heel of p^4, which fits into this emargination. The small cusp 5 catches the labial side of, and works against, the small antero-internal cusp on the front margin of the heel of p^4. The lingual, low, and cingulum-like portion of the tooth is rather larger than in p_1, chiefly owing to its action against the front of the heel of p^4; there can be little doubt that this lingual portion of p_4, like the corresponding portion of p_1, in fact represents the degenerated cusp 2 (compare the lower premolars in insectivorous bats).

m^1 (text-figs. 41 A, C).—Enormously expanded in transversal direction, its breadth being about $1\frac{1}{2}$ its length at the labial margin; considerably shorter at lingual than at labial margin. Cusps 1, 2, and 3 have entirely disappeared. The external, trenchant margin of m^1 is formed anteriorly by the triangular cusp 4, rising to about half the height of the principal cusp of p^4, posteriorly by the much lower, obliquely triangular cusp 5; cusp 4

works against the posterior margin of cusp 4 and the anterior margin of cusp 5 of the lower m_1, cusp 5 against the posterior margin of cusp 5 of m_1 and the whole of cusp 4 of m_2. At the antero-internal corner of the heel of m^1 (at level with the lingual margin of the heel of p^4) is seen the low, but strong, triangularly projecting cusp 6; it fits into a depression in m_1, immediately behind cusp 2 of this latter tooth, and has checked the growth of cusp 3 of m_1, which consequently has become quite rudimentary. The large postero-internal, inwardly projecting lobe of m^1 represents cusp 7. The whole lingual portion of m^1, bordered externally by cusps 4 and 5, in front by cusp 6, internally by the lingual margin of cusp 7, and behind by the very low posterior margin of the tooth, forms a large crushing surface, the enamel of which is densely wrinkled and extends on the lingual face of cusps 4 and 5 almost to their tips, thus forming an "inner cingulum" to these cusps. This crushing surface consists chiefly of two concavities; the one, bordered externally by cusps 4 and 5, internally by cusp 6, wears against the whole posterior portion (cusps 3 and 5) of m_1; the other, immediately behind cusp 6 and the somewhat projecting antero-internal margin of cusp 7, is acted upon by the high, slender, conical cusp 2 of m_2.

m^2 (text-figs. 41 A, C).—Broader than long, but not so broad as m^1; the elements are the same as in m^1, but their arrangement somewhat different. Cusps 4 and 5 strong, but much lower than in m^1. The shape and size of cusp 4 is determined by that portion of the lower m_2 against which it has to work, viz., the hinder margin of cusp 4 and the front margin of cusp 5. Cusp 5 is not (as in m^1) situated in a line immediately behind cusp 4, but has moved to the middle of the posterior margin of the tooth, where it forms a strong, backwardly projecting tubercle; this shifting of the position of cusp 5 has been necessitated, because it has to work against the hinder margin of cusp 5 of m_2 and the small m_3. Cusp 6 has almost exactly the same position, shape, and size as in m^1; it acts upon the anterior and external face of cusp 3 of m_2. Cusp 7, which in m^1 is so enormously developed, is in m^2 quite small, represented by a low, but perfectly distinct shelf at the postero-internal corner of the tooth; its small size is easily understood when seeing that it has to work only against the posterior margin of cusp 3 of m_2 and the front of the very small m_3. The median portion of m^2 forms a large crushing surface, the enamel of which is densely wrinkled, as in m^1, and produced into a distinct inner cingulum to cusps 4 and 5. This crushing surface is deeply hollowed out in the middle, owing to the strong pressure of the whole posterior portion (cusps 3 and 5) of m_2.

m^3 (text-figs. 41 A, C).—Rudimentary, as small as a lower incisor (scarcely $\frac{1}{15}$ the size of m^2). The tooth has been pushed postero-internally to m^2, pressed into an angular emargination between cusps 5 and 7 of this latter tooth; its elements cannot be discriminated. Quite functionless the tooth is not; its antero-internal portion is acted upon by the posterior portion of the small lower

m_3; but its postero-external portion cannot, so far as I can see, be touched by m_3.

m_1 (text-figs. 41 B, C).—Longer than broad, abruptly narrowed in front. Cusp 1 practically wanting; in some specimens of *A. planirostris* (and, more often, in *A. jamaicensis*) a faint trace of cusp 1 is detectable, as an excessively small prominence, immediately in front of cusp 2, but generally it has entirely disappeared and only its commissure with cusp 4 been partly preserved; it is the constant pressure of this portion of m_1 against the anterior margin of the heel of p^4 which has caused the disappearance of cusp 1. Cusp 2 strongly developed, as a high slender cone, situated very near the middle of the labial margin, close to, but not contiguous with, the cingulum; this cusp works against the postero-internal portion of the heel of p^4, which it has pressed low and concave. Cusp 3, at the postero-internal corner, extremely small, barely projecting above the level of the cingulum, acts against the hinder face of cusp 6 of m^1. Cusp 4 (antero-externally) long, but low, triangular, trenchant, acting against the heel of p^4; the action of this cusp is the chief cause of the strong development of the heel of p^4. Cusp 5 (postero-externally) long, much lower than cusp 4, only slightly projecting, triangular; it works against the external half of the crushing surface of m^1 (the depression bordered by cusps 4–5 and cusp 6 of this tooth). The enamel of the crushing surface of m^1 is densely wrinkled.

m_2 (text-figs. 41 B, C).—Slightly smaller than m_1, subrectangular, a little longer than broad. Cusp 1 is represented by a very small (but distinct) tubercle at the middle of the front margin of the tooth. Cusp 2, antero-internally, quite of the same shape as the corresponding cusp in m_1, only slightly lower; the action of this cusp is the chief cause of the strong development of cusp 7 in m^1. Cusp 3, postero-internally, quite small, but not so strongly reduced as in m_1; it acts against the postero-external face of cusp 6 and the front of cusp 7 of m^2. Between cusps 2 and 3 the cingulum has developed an exceedingly small supplementary cusp. Cusps 4 and 5 very similar to the corresponding cusps of m_1, but much lower; the former acts against the posterior portion of the crushing surface of m^1 (lingually to cusp 5), the latter against the large crushing surface of m^2 (between cusps 4 and 5 externally, and cusp 6 internally), which it has made deeply concave. Crushing surface of m_2 wrinkled as in m_1.

m_3 (text-figs. 41 B, C).—Rudimentary, $\frac{1}{8}$–$\frac{1}{10}$ the size of m_2. Cusps 2 and 4 are rather easily detectable. It works against the postero-internal margin of m^2 and the antero-internal portion of the rudimentary m^3.

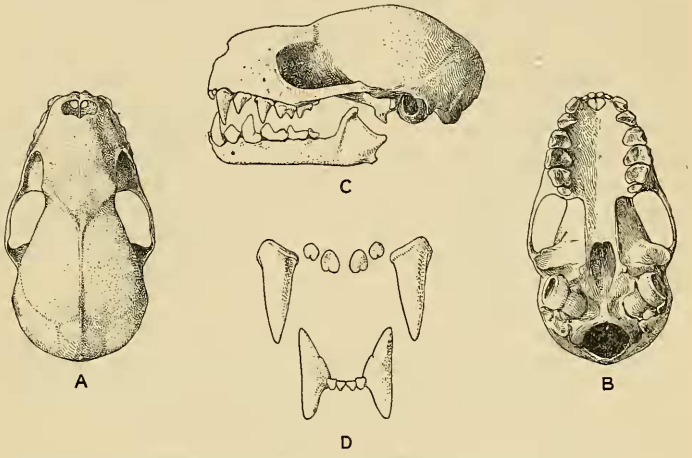
Uroderma Pet.

1865. *Uroderma* Peters, MB. Akad. Berlin, pp. 587–88, footnote.—Type: *Phyllostoma personatum* Pet. 1865 (not Wagner) = *Uroderma bilobatum* Pet. 1866.
1878. *Artibeus* Leach (partim), Dobson, Cat. Chir. Brit. Mus. p. 514.
1901. *Uroderma* Pet., Rehn, Proc. Ac. Nat. Sci. Philad. 1900, p. 757 (9 Febr. 1901).—Remarks on the genus.

The subjoined characterisation is confined to the points in which *Uroderma* differs from *Artibeus*.

Skull (text-fig. 42, compare fig. 43).—Long and slender, in general shape somewhat recalling a *Putorius nivalis* skull.—Rostrum but

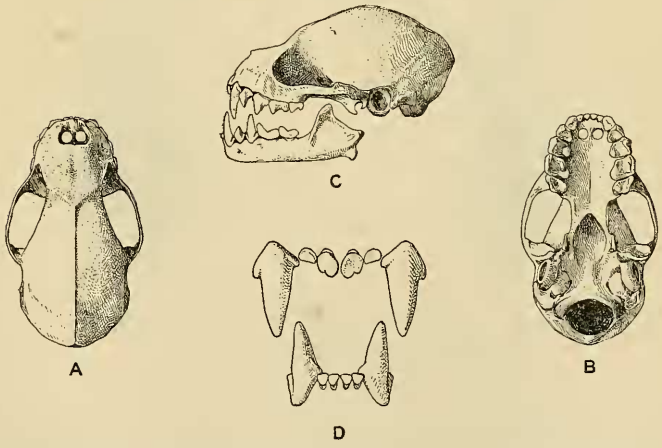
Text-fig. 42.



Uroderma bilobatum, ♀ ad. Para. B.M. 1.7.19.4.

Upper, lower, and side view of skull; front view of incisors and canines. A, B, C × $\frac{3}{2}$, D × $\frac{4}{1}$.

Text-fig. 43.



Artibeus cinereus cinereus, ♂ ad. Para. B.M. 1.7.19.3.

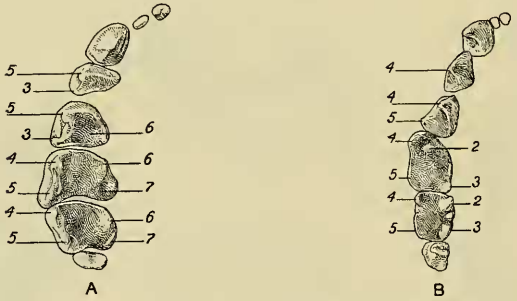
Upper, lower, and side view of skull; front view of incisors and canines (for comparison with *Uroderma*). A, B, C × $\frac{3}{2}$, D × $\frac{4}{1}$.

very slightly depressed; profile of skull, therefore, showing an almost straight line from the highest point of the brain-case to the tip of the nasals (text-fig. 42 C); height of rostrum at p^4 greater than, or at least equal to, width of skull at "postorbital" constriction (immediately behind postorbital processes or their rudiments). In *Artibeus* the rostrum is considerably more depressed and flattened; the outline in profile, from the front of the sagittal crest to the base of the nasals, steep (text-fig. 43 C); the height of the rostrum at p^4 considerably less than the width of the postorbital constriction.—Bony palate long: distance from palation to front of incisors very nearly equal to zygomatic width of skull (text-fig. 42 B); in *Artibeus* much less than zygomatic width (text-fig. 43 B).—Median backwardly extending portion of bony palate (behind m^3) long, equal to the combined length (externally) of m^1 and m^2; in *Artibeus* much less than this latter, often only equal to the length of m^1.—Anterior nasal opening less oblique, looking chiefly forwards; in *Artibeus* noticeably more oblique, looking upwards and forwards.

Teeth (text-figs. 44 and 47).—Chief characters, as compared with the teeth of *Artibeus* (see text-figs. 46, on p. 215, and 48, on p. 216):—outer upper incisors bifid; cusp 2 in m_1 small and more anterior in position; m^3 and m_3 always present; m^3 situated direct behind (not postero-internally to) m^2, and almost as broad as the hinder border of this latter.—The details are these:—

(1) Cutting-edges both of inner and outer upper incisors bifid (text-fig. 42 D, on p. 213); in *Artibeus*, inner incisors bifid, outer incisors simple (text-fig. 43 D, on p. 213).—(2) The cingulum of

Text-fig. 44.

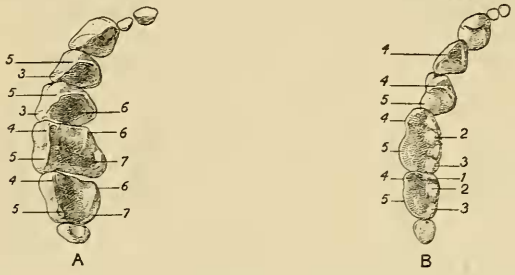


Uroderma bilobatum, ♀ ad. Para. B.M. 1.7.19.4.
A. Right upper, B. Left lower tooth-row. × 1.
For explanation of lettering of cusps see text, p. 205.

the lower canine extends, on the inner side, upwards to (or almost to) the middle of the tooth, often terminating in a small cusp-like projection (text-fig. 47); in *Artibeus* the cingulum terminates at about the level of the cutting-edges of the lower incisors,

without forming a cusp-like projection (text-fig. 48).—(3) Cusp 4 (anterior cusp) of p^4 more developed than in *Artibeus*, as a rule forming a small, but distinct, pointed cusp in the unworn tooth; in *Artibeus* cusp 4 of p^4 is practically completely wanting.—(4) m^3 is small, but not nearly reduced to the same degree as in *Artibeus*, situated direct behind m^2, and almost (or quite) as broad

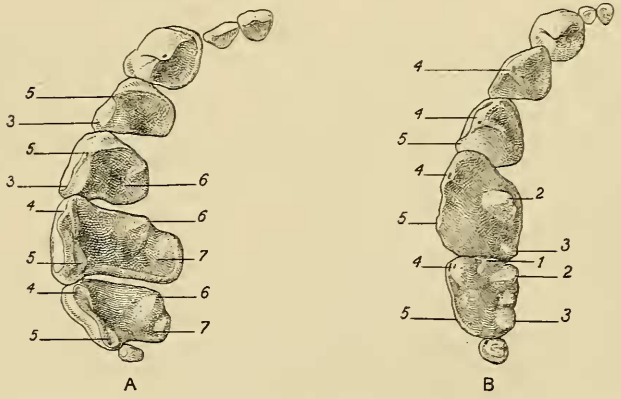
Text-fig. 45.



Enchisthenes harti, ♂ imm. Trinidad. Type, B.M. 92.9.7.8.

A. Right upper, B. Left lower tooth-row. × 4/1.

Text-fig. 46.



Artibeus planirostris fallax, ♀ ad. Kanuku Mts., British Guiana. B.M. 1.6.4.60.

A. Right upper, B. Left lower tooth-row. × 4/1.

For explanation of lettering of cusps see text, p. 205.

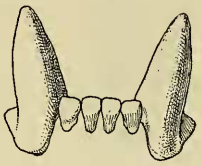
as the hinder margin of m^2 (text-fig. 44 A); of the elements of m^3, cusps 4 and 6 are clearly observable, cusps 5 and 7 only present as mere rudiments; in cross section m^3 is about six times the size of a lower incisor, or 1/8 of m^2; in *Artibeus* m^3, when present, is

quite rudimentary (equal to a lower incisor, or about $\frac{1}{15}$ of m^2), its elements cannot be discriminated, and the tooth has been pushed postero-internally to m^2 (text-fig. 46 A); but in most species of *Artibeus* m^3 is entirely wanting.—(5) As a consequence of the larger size and posterior position of m^3 in *Uroderma*, cusp 5 of m^2 is considerably more labial in position (text-fig. 44 A); in *Artibeus* the cusp has moved so far towards the lingual side as to occupy, precisely or very nearly, the middle of the posterior margin of the tooth (text-fig. 46 A).—(6) Cusp 2 of m_1 is in *Uroderma* represented by a low subacutely pointed tubercle near

Text-fig. 47.

Text-fig. 47.—*Uroderma thomasi*, ♂ ad. Bellavista, Bolivia. Type, B.M. 1.2.1.37. Front view of lower incisors and canines. × $\frac{4}{1}$.

Text-fig. 48.



Text-fig. 48.—*Artibeus jamaicensis lituratus*, ♀ ad. Villa Rica, Paraguay. U.S.N.M. 105587.
Front view of lower incisors and canines. × $\frac{4}{1}$.

the front end of the tooth and close to the lingual side of cusp 4 (text-fig. 44 B); in *Artibeus* cusp 2 is very strongly developed, rising as a high slender cone near the middle of the lingual margin of m_1 (text-fig. 46 B).—(7) In accordance with the less reduced size of m^3, also m_3 in *Uroderma* is proportionately larger, equal to $\frac{1}{3}$–$\frac{1}{4}$ of m_3 (text-fig. 44 B); in *Artibeus* m_3 is $\frac{1}{8}$–$\frac{1}{12}$ the size of m_2, or, in more than half the number of species, entirely wanting.

External characters.—The lateral margin of the horseshoe, at level with nostrils, is turned upwards so as to form a conspicuous fold; when pressed downward to the muzzle this fold takes the shape of a small, rounded lobe, slightly projecting beyond the rest of the lateral margin. In several species of *Artibeus* (*A. planirostris*, *jamaicensis*, etc.) there is a similar, though rather less pronounced folding of the lateral margin of the horseshoe. The difference between *Uroderma* and *Artibeus* in this respect is, therefore, only one of degree.

The wing-structure is very similar to that of *Artibeus*; the fifth metacarpal averages a trifle shorter than the third, whereas in all species of *Artibeus* it is generally a trifle longer than the third. How closely in all other respects the wing-structure of *Uroderma* resembles that of *Artibeus* may be seen by reference to the wing-indices on p. 310 (compare, for instance, the indices of *Uroderma* with those of *A. rosenbergi*).

Uroderma has a narrow line of whitish fur down the middle of the upper side, sometimes ill-defined, but never quite obliterated; *Artibeus* has no trace of a dorsal line.

Species.—Two, *U. bilobatum* and *thomasi*.

Range.—From São Paulo and Bolivia to Costa Rica; unrepresented in the West Indies (Trinidad excepted).

Remarks.—*Uroderma* was proposed by Peters (*l. s. c.*) as a generic name for those known species of "*Artibeus*" which have $\frac{3}{3}$ molars, viz., at Peters's time, *A. bilobatus*, *fallax*, and *concolor*. The name, in this sense, was adopted by Dobson (*l. s. c.*), though only as the designation of a "subgenus" of *Artibeus*, and he recognised two species only, *A. bilobatus* and *planirostris*, the latter including Peters's *fallax* as a "synonym" and *concolor* as a "variety." The number of species would now be five: *bilobatus*, *thomasi*, *concolor*, *planirostris*, *hirsutus*.—In 1901, Rehn (*l. s. c.*) proposed to restrict the name *Uroderma* to *A. bilobatus*, on account of its elongate skull, noticeably higher rostrum, and "two rounded lobes" on the lateral margins of the horseshoe.

Any subdivision of the genus "*Artibeus*," in its old sense, according to the number of molars ($\frac{3}{3}$, $\frac{2}{3}$, or $\frac{2}{2}$) is artificial. The natural subdivisions are these two: *A. bilobatus* and *thomasi* on one side (*Uroderma*), all other species on the other (*Artibeus*). There is a wide gap between *Uroderma* and *Artibeus*, in this sense, whereas all species referred to *Artibeus* in the present paper, irrespective of the presence or absence of the rudimentary m^3 and m_3, are extremely closely inter-related. *Uroderma* differs both in the shape of the skull and in several important dental characters, and it is in these respects not approximated by any species of *Artibeus*. As to the dental characters pointed out above (pp. 214–216), nos. 1 (bilobate outer upper incisors), 4 (position of m^3), 5 (position of cusp 5 of m^2), and 6 (no cusp 2 in m_1) constitute absolute differences between *Uroderma* and *Artibeus*, though a slight restriction is perhaps advisable with regard to no. 1, in so far as in some species of *Artibeus* the outer upper incisor can show, rarely and as a perfectly individual aberration, a faint leaning towards a bifid shape; as to nos. 2 (cingulum of lower canines), 3 (cusp 4 of p^4), and 7 (size of m_3), the difference is one of degree only. In having a narrow line of white fur down the middle of the upper side, *Uroderma* is similar to the majority of species of *Vampyrops* and allied genera, but different from all species of *Artibeus*.

Uroderma bilobatum Pet.

1842. *Phyllostoma species inedita* Rüppell, Verzeichniss der in dem Museum der Senckenbergischen naturforschenden Gesellschaft aufgestellten Sammlungen, i. p. 11, no. II. D. 3 *a*.—Brazil?

1865. *Phyllostoma personatum* (not Wagner) Peters, MB. Akad. Berlin, pp. 587–88, footnote.

1866. *Uroderma bilobatum* Peters, MB. Akad. Berlin, p. 394.—São Paulo; Cayenne.

1878. *Artibeus bilobatus* Pet., Dobson, Cat. Chir. Brit. Mus. pp. 518–19.

1880. *Artibeus* (*Uroderma*) *bilobatus* Pet., Thomas, P. Z. S. p. 396.—Sarayacu, Ecuador.

1889. *Artibeus bilobatus* Pet., Cope, Amer. Naturalist, xxiii. no. 26, pp. 130–31 (Febr. 1889).—"Chapada" [probably Chapadas da S. Maria, N. Minas Geraes].
1897. *Artibeus bilobatus* Pet., J. A. Allen & Chapman, Bull. Am. Mus. N. H. ix. Art. ii. p. 15 (26 Febr. 1897).—Trinidad, W. I.
1900. *Uroderma bilobatum* Pet., J. A. Allen, Bull. Am. Mus. N. H. xiii. Art. viii. p. 89 (12 May, 1900).—Santa Marta region, Colombia.
1901. *Artibeus bilobatus* Pet., Thomas, Ann. & Mag. N. H. (7) viii. p. 191 (Sept. 1901).—Para.
1902. *Uroderma convexum* Lyon, Proc. Biol. Soc. Wash. xv. pp. 83–84 (25 April, 1902).—Colon, Panama.
1904. *Uroderma bilobatum* Pet., J. A. Allen, Bull. Am. Mus. N. H. xx. Art. xxxv. p. 458 (28 Nov. 1904).—Ciudad Bolivar, Venezuela.
1906. *Uroderma bilobatum* Pet., Peters, Chir. Mus. Zool. Berol. pl. xi. *a* (issued Jan. 1906).

Diagnosis.—Skull small, tooth-rows short, ears small.

U. bilobatum and *thomasi.*—The difference between these two species will be pointed out below, p. 221.

Hairing on limbs and interfemoral.—Forearm densely haired for the proximal two thirds of its upper surface. A tuft of short hairs on the metacarpal of the pollex. Upper side of tibia and foot distinctly haired. Interfemoral very short-haired, its hinder margin almost naked.

Colour.—General impression brown, varying in shade; four facial stripes, a dorsal stripe. There are two colour extremes, a dark brown and a light brown, but the contrast between them is by no means great.

Dark-coloured examples (many skins, all of fully adult individuals, teeth unworn or slightly worn; localities: Colombia (Cali; Santa Marta), islands off Panama, Chiriqui):—Upper side dark brown, darker than Ridgway's Prout's brown; base of hairs on hinder back approaching drab, on the neck lighter, varying from light drab to wood-brown or ecru-drab. Under side a dark shade of drab. Supraorbital and infraorbital stripes broad, whitish. A narrow whitish longitudinal stripe from the occiput to the interfemoral; front half of the stripe sometimes very indistinct or quite obliterated. A more or less distinct narrow whitish margin to the ears.

Three examples (Chanchamayo, Peru, and Brava I., W. of Panama; adults, with unworn or very slightly worn teeth) are noticeably darker: upper side sooty brown, under side dark smoky grey.

Lighter-coloured examples (two skins: Egas, Amazonas, and Valencia, Venezuela; adults, with unworn teeth):—Upper side Prout's brown (one skin) or mars-brown washed with russet (the other), base of hairs wood-brown; under side light drab. Facial stripes, dorsal line, and ear-edgings as usual.

Individuals from different localities.—Specimens have been examined from localities dotted over practically the whole area from Para, Amazonas, and Peru in the south, to Costa Rica in the north. I am unable to see any differences, in the skull, teeth, or external characters, between individuals from all these localities. The subjoined table of measurements (p. 219), in which the specimens have been arranged according to their geographical habitat, shows that also the dimensions are the same.

Measurements of Uroderma bilobatum.

	Para.	Amazonas.	Peru.		Ecuador.	S. Colombia.	S. Marta, Colombia; Valencia, Venezuela.		Colon.		Islands off Panama.		Chiriqui.		Costa Rica.
	1 adult, 1 skull.	1 adult, 1 skull.	2 adults, 2 skulls.		1 adult, 1 skull.	1 adult, 1 skull.	3 adults, 3 skulls.		2 yg. adults, 2 skulls.		9 adults, 8 skulls.		2 adults, 2 skulls.		1 adult, 1 skull.
			Min.	Max.			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length, to front of c	23·2	.....	23·3		.....	.....	22	22·5	22·7		22·8		.....		23
„ mastoid width	11·2	.....	11·3		.....	.....	...	11·2	11		...	11·2			
„ width of brain-case	9·8	.....	10		10	.....	...	10	...	10	9·7	9·8	9·8	9·8	
„ zygomatic width	12·8	.....	13	13·7	13	.....	.....		12·8		13		13	13	
„ maxillary width, across m^1	9·2	8·9	9·2	9·8	9·2	9·3	9	9·2	8·8	8·9	9	9·7	9	9·8	9·3
„ across cingula of canines	5·8	5·5	...	6·2	5·8	6	5·8	6	5·7		5·7	5·9	5·8	6	
Mandible, to front of inc.	15·8	15·6	16·2	16·2	16	15·7	15·2	15·8	15	15·2	15	15·7	15·8	16	15·8
Upper teeth, c–m^3	8·2	8	8·2		8·2	8	8	8·2	8·2	8·2	7·8	8·2	8·2	8·5	8·2
Lower teeth, c–m_3	8·8	8·8	8·8	9	9	8·8	8·7	9	8·8	9	8·5	9	9	9	8·8
Ear-conch, length, inner margin	11·5	.....	.....		.....	.....	.....		11	11·2					
„ length, outer margin	16·8	.....	.....		.....	.....	.....		15·7	16					
„ width	12	.....	.....		.....	.....	.....		11	11·5					
Tragus, length	5·8	.....	.....		.....	.....	.....		5·8	5·8					
Lancet, length	9·2	.....	.....		.....	.....	.....		8·3						
„ width	5	.....	.....		.....	.....	.....		4·8						
Horseshoe, width	7·5	.....	.....		.....	.....	.....		6·2						
Forearm	44·7	43	42·2	44·2	41	.....	40	43	42	43·2	...	44	43·2	45	43·2
Pollex	.....	.....	...	12	12·2	.....	11	11·8	11	11	11·2	12	11·2	12	
3rd metacarpal	42·2	40	41·2	41·8	39·8	38	37·8	40·2	39	39·7	38·2	41·7	41·8	42·5	39
III^1	14·8	15·5	16	16	15	14·5	14·7	14·9	14·5	14·8	14	16	14·7	15·2	14·7
III^2	23·7	21·5	22·5	23·8	22·2	21	21	23·2	21·8	22·5	21·2	23	22·5	23·2	21·5
III^3	11·8	.....	11·5		11·8	.....	10·8	12	11·7	12·2	10·5	12·7	11·5	12	12·2
4th metacarpal	40·3	38·7	41	41·2	39	36·8	37	39·8	38	39	37·5	40	39·5	40	38·7
IV^1	13	12·2	13·2	13·2	12·2	12·2	11·8	13·2	12·5	13	12	13·2	12·5	12·8	12·2
IV^2	15	14·5	13	14·8	12·8	14	12·8	13	13·2	13·8	13·2	13·8	13·7	14·8	14
5th metacarpal	41	40	41	41·8	39	37·5	38·5	39·8	37	39·6	39	41	40·5	41	39·7
V^1	9·8	10·2	10·2	10·8	10	9·7	9·2	9·8	10·2	10·2	9·2	10·7	9·2	9·8	9·5
V^2	12·8	.....	12	13	12	.....	11	11·8	11·8	12	11·8	12·7	11·8	12·2	13
Interfemoral	15	.....	.....		.....	.....	.....		13·5						
Lower leg	16	16·7	16·8	17·8	.....	15·8	15	16·8	15·7	17	15·8	17·8	16·2	16·5	
Foot, with claws	11·2	.....	...		11·5	.....	10·7	11	10·2	11·2	11	12·2	11·5	12	
Calcar	5·5	.....	...	6	.....	.....	5	5·5	4·7						

Specimens examined.—24 specimens (19 skins) and 23 skulls, from the following localities :—

British Museum :—Brazil : Para (1); Egas (Teffé), Amazonas (1).—Peru : Chanchamayo, 1200 and 1500 m. (2).—Ecuador : Sarayacu (1).—Colombia : Cali, 1100 m. (1); Onaca, Santa Marta, 700 m. (2).—Venezuela : Valencia (1).—Panama : Colon (1); Chiriqui (2); islands off Panama : Brava I. (3); Cebago I. (1); Jicaron I. (1); Insoleta (1); Gobernador I. (3).—Costa Rica; Miravalles, 400–500 m. (1).—21 skulls, from all the localities enumerated.

U.S. National Museum * :—Trinidad : Port of Spain (1).—Panama : Colon (1).—Skulls of both specimens.

Range.—From São Paulo and Peru, at least as far north as Costa Rica; unrepresented in the West Indies (Trinidad excepted).

Peters's *Uroderma bilobatum*, 1866.—The type, in the Berlin Museum, is "ein jüngeres Exemplar aus St. Paulo in Brasilien"; Peters had also "zwei andere ausgewachsene [Exemplare] aus Cayenne" in the Berlin Museum, and "ein männliches ausgewachsenes Exemplar in Weingeist" from the Frankfurt Museum without exact locality (*cf.* Rüppell, *l. s. c.*). The whole of the original description and all measurements (there is an obvious error in the measurement of the second phalanx of the fourth digit) precisely agree with the series of specimens here referred to *U. bilobatum*.—The figures in the plate belonging to Peters's intended Monograph of Bats (*l. s. c.*) are excellently drawn and partly well reproduced, but the hind legs in the life-size figure (fig. 1) are much too short, as if drawn from a damaged specimen (with broken legs?).

Lyon's *Uroderma convexum*, 1902.—Type : ♀ young ad.; Colon, Panama. Based on two specimens from the type locality. For comparison Lyon had two *U. bilobatum* from Chapada, Brazil (probably São João River, Chapada da S. Maria, N. Minas Geraes; and probably the same specimens as recorded by Cope, 1889, *l. s. c.*, and by Rehn, 1901, *l. s. c.*).—The characters of *U. convexum* are summed up, by Lyon, as follows : "Similar to *U. bilobatum* Peters, but with tooth-rows distinctly arcuate" ("less nearly parallel than those of *U. bilobatum*").

Besides a specimen from Colon in the British Museum (presented by Marquis Doria), nine specimens from islands W. of Panama, two from Chiriqui, and one from Costa Rica, I have had for examination Lyon's paratype, a young adult from Colon.—"*U. convexum*" is in every respect indistinguishable from *U. bilobatum* from Brazil, Peru, Ecuador, Colombia, Venezuela, and Trinidad. In the whole series of skulls of *U. bilobatum* examined, 23 in number, the upper tooth-rows are decidedly arcuate; by close comparison of the skulls an excessively small variation in the outline of the tooth-rows is, of course, observable, as is also the

* U.S. N. M. nos. 22472 (37901), 111721.

case in any sufficiently large series of skulls of any species of *Artibeus*, *Vampyrops*, &c.; but these minute variations are entirely independent of differences in the geographical habitat of the individuals. The straightest tooth-row I have seen is in a skull from Colon (the type locality of *U. convexum*) and in one from Chiriqui; the most arcuate in one from Peru, one from Para, and one from Chiriqui; the others are, of course, intermediate.

Uroderma thomasi K. And.

1906. *Uroderma thomasi* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 419 (1 Dec. 1906).—Bellavista, Bolivia.

Diagnosis.—Similar to *U. bilobatum*, but with noticeably larger skull, longer tooth-rows, and larger ears and nose-leaves.

U. thomasi and *bilobatum*.—*U. thomasi* differs from *U. bilobatum* in the following particulars:—

The skull is precisely of the same shape as in *U. bilobatum*, but in every respect larger; the *largest* skull (out of 23) of *U. bilobatum* measures in total length 23·3 mm., the *smallest* skull of two *U. thomasi* 24·7 mm.; all other dimensions of the skull are correspondingly increased.—In the whole series of *U. bilobatum* examined the length of the maxillary tooth-row varies between 7·8 and 8·5 mm. (average 8·1 mm.), in *U. thomasi* it measures 8·9–9 mm. The ears are not only absolutely, but proportionately larger. The lancet longer and, especially, broader.—For further details see the table, below p. 223.

U. thomasi is, probably, the Bolivian representative of *U. bilobatum*; but in all the points referred to above there seems to be a perfectly clear line of separation between the two forms; the gap between them is not overbridged by any specimen I have seen.

The distribution of the fur on the limbs and interfemoral is as in *U. bilobatum*. The colour of the pelage as in the ordinary dark brown "phase" of that species; the whitish ear-edgings are very distinct.

Specimens examined.—Two, with skulls, viz., ♂ ad., Bellavista, Bolivia, 1400 m., about 15° S., 68° W. (type specimen); and ♂ ad., Reyes, Bolivia, about 13° S., 67° W. (presented by Marquis Doria). Both specimens in the collection of the British Museum.

Range.—As yet known from N. Bolivia only.

Enchisthenes K. And.

1906. *Enchisthenes* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 419 (1 Dec. 1906).—Type: *Artibeus harti* Thos.

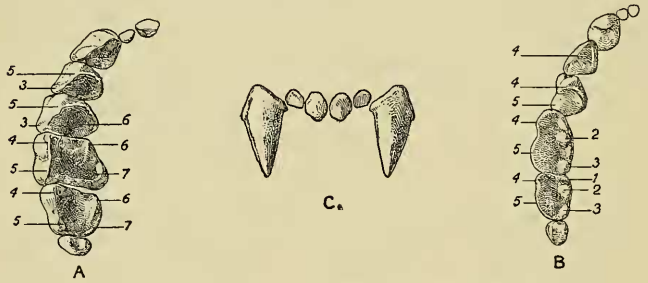
Diagnosis.—Allied to *Artibeus*, but median upper incisors simple; m^3 in row, as broad as the hinder margin of m^2; m_3 comparatively large, equal to about $\frac{1}{4}$ of m_2; tragus with a pointed projection on the inner margin, near the tip.

Enchisthenes, *Artibeus*, and *Uroderma*.—*Enchisthenes* is much more closely allied to *Artibeus* than to *Uroderma*. In all the characters which separate *Uroderma* from *Artibeus*, *Enchisthenes* agrees with the latter genus, the following points excepted: the position and relative size of m^3 and the relative size of m_3 are as in *Uroderma*; as a consequence of the former fact, also the position of cusp 5 of m^2 is as in *Uroderma*. *Enchisthenes* differs from *Artibeus* chiefly in the particulars referred to above, in the diagnosis of the genus.

Principal characters.—The skull has all the characters of an *Artibeus* skull: short and broad, not long and subcylindrical as in *Uroderma*; profile, from front of sagittal crest to nasals, much concave, as in *Artibeus*, not very slightly concave or almost straight, as in *Uroderma*; palate short, as in *Artibeus*, not long as in *Uroderma*; plane of anterior nasal openings very oblique, as in *Artibeus*, not looking chiefly forward, as in *Uroderma*.

Cutting-edges of median upper incisors simple, pointed in the centre, without any indication of a median notch (text-fig. 49 c); in this respect *Enchisthenes* differs both from *Artibeus* (median upper incisors bifid) and *Uroderma* (all upper incisors bifid). Outer upper incisors somewhat narrower and much shorter than median

Text-fig. 49.



Enchisthenes harti, ♂ imm. Trinidad. Type, B.M. 92.9.7.8.

A. Right upper, B. Left lower tooth-row; C. Front view of upper incisors and canines. × $\frac{4}{1}$.

incisors; cutting-edge simple. p^3 and p^4 as in *Artibeus* and *Uroderma*. Cusp 7 of m^1 well developed, but rather small, more recalling the corresponding cusp in *Uroderma* than that of *Artibeus*. Position of cusp 5 of m^2 as in *Uroderma*, not at (or very nearly at) the middle of the hinder margin of the tooth, as in *Artibeus*; cusp 7 of m^2 so excessively small as to be scarcely observable without a lens, forming only a very low postero-internal margin to the tooth. m^3 *situated direct behind* m^2, in position and shape quite as in *Uroderma*, not rudimentary and situated postero-internally to m^2, as in *Artibeus* (compare text-fig. 45 A with text-figs. 44 A and 46 A on pp. 214 and 215). Cingulum on inner side of lower canines

(next to i_3) low, terminating at level with cutting-edges of incisors, as in *Artibeus*. Cusp 4 of p^4 practically completely wanting, as in *Artibeus*. Cusp 2 of m_1 very much as in *Artibeus* (perhaps a trifle more anterior in position); the cusp is situated so close to the lingual cingulum as to appear, on cursory inspection, in direct connection with this latter; in reality the cingulum passes the lingual side of the cusp, as in *Artibeus*; between cusps 2 and 3 the cingulum has developed two very small supplementary tubercles. Cusp 1 of m_2 (antero-internally, direct in front of cusp 2) small, but quite distinct. m_3 of the same relative size as in *Uroderma*, viz. equal to about $\frac{1}{4}$ the bulk of m_2.

A very conspicuous, pointed, upwardly directed *projection on the inner margin of the tragus*, about 1 mm. below the tip. Neither

Measurements of Uroderma bilobatum *and* thomasi, *and* Enchisthenes harti.

	U. bilobatum.			*U. thomasi.*		*E. harti.*
	23 adults, 22 skulls.			2 adults, 2 skulls.		Type, ♂ yg. ad.
	Min.	Max.	Med.	Min.	Max.	
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length, to front of c	22	23·3	22·8	24·7	24·8	20·8
„ mastoid width	11	11·3	11·2	12	12·2	11
„ width of brain-case	9·7	10	9·9	10·6	10·8	9·7
„ zygomatic width	12·8	13·7	13	14	14·2	12·5
„ maxillary width, across m^1	8·8	9·8	9·2	10	10	8·3
„ across cingula of canines	5·5	6·2	5·9	6·1	6·2	5·8
Mandible, to front of inc.	15	16·2	15·6	16·8	16·8	14·2
Upper teeth, c–m^3	7·8	8·5	8·1	8·9	9	7·2
Lower teeth, c–m_3	8·5	9	8·9	9·5	9·7	8
Ear-conch, length, inner margin	11	11·5		12·3	13	
„ length, outer margin	15·7	16·8		18	18·5	
„ width	11	12		12·8	13·7	
Tragus, length	5·8	5·8		7	7	
Lancet, length	8·3	9·2		10	10	6
„ width	4·8	5		6·2	6·5	5
Horseshoe, width	6·2	7·5		7·8	8	6·2
Forearm	40	45	43	44	45	38
Pollex	11	12·2	11·6	12	12·2	10·2
3rd metacarpal	37·8	42·5	40·3	42	42	34·5
III^1	14	16	14·9	14·8	16·5	13
III^2	21	23·8	22·3	23·2	23·5	17·2
III^3	10·5	12·7	11·7	13·2	14	12
4th metacarpal	36·8	41·2	39·1	40·5	41·7	33·2
IV^1	11·8	13·2	12·7	12·8	13·5	11·7
IV^2	12·8	15	13·7	14·2	14·8	10·8
5th metacarpal	37	41·8	39·9	41·7	42	33·8
V^1	9·2	10·8	10	9·7	11	9·2
V^2	11	13	12·1	12·2	12·8	9·2
Interfemoral	13·5	15		14·2	17·8	
Lower leg	15	17·8	16·4	17	18	13
Foot, with claws	10·2	12·2	11·3	11·8	12·2	10
Calcar	4·7	6	5·3	5·8	6·8	5·2

in *Artibeus* nor in *Uroderma* is there any trace of a similar projection.

The material is unsuitable for a description of the wing-structure, the only specimen known being a young adult. It would seem, however, that the wing-indices do not differ very essentially from those of *Artibeus*; the second phalanx of the third digit is, apparently, relatively rather short, less than $1\frac{1}{2}$ the length of the first phalanx.

Species.—The type of the genus is the only species known.

Range.—Trinidad.

Enchisthenes harti Thos.

892. *Artibeus harti* Thomas, Ann. & Mag. N. H. (6) x. pp. 409–10 (Nov. 1892).

Diagnosis.—Upper tooth-row 8 mm.; forearm 38 mm.

Nose-leaves.—Horseshoe in front completely fastened down to and continuous with the integument of the muzzle; lateral part turned up into a slight fold, somewhat recalling the fold in a *Uroderma* horseshoe, but not forming a small rounded lobe. *Lancet* unusually short and broad, the width at base being almost equal to $\frac{5}{6}$ its length from nostrils to tip.

Interfemoral.—Extremely short, only about 3–4 mm. in the middle line.

Fur on limbs and interfemoral.—Upper side of proximal two thirds of forearm, the whole of the interfemoral, and upper side of tibia and foot, densely haired. A tuft of very short hairs on the metacarpal of the pollex.

Colour (of an immature specimen, preserved in alcohol).—The colour of the fur would seem to be much as in the light phase of *Artibeus toltecus ravus* (below p. 300). Details as to the facial stripes and ear-margins cannot be given from the only specimen available, which is not in a perfect state of preservation.

Measurements.—On p. 223.

Specimens examined.—One, the type, a young adult male, in the collection of the British Museum.

Range.—As yet only one record, from the island of Trinidad, W.I.

Artibeus Leach.

1821. *Artibeus* Leach, Trans. Linn. Soc. London, xiii. pt. i. pp. 74–75.—Type: *Artibeus jamaicensis* Leach.

1821. *Madatæus* Leach, op. cit. pp. 74, 81–82.—Type: *Madatæus lewisii* Leach (=*Artibeus jamaicensis* Leach).

1827. *Medateus* Gray, Griffith's Animal Kingdom, v. p. 74.—Misspelling of *Madatæus*.

1835. *Arctibeus* Gray, Mag. Zool. & Bot. ii. pp. 486–87.—Misspelling of *Artibeus*.

1856. *Pteroderma* Gervais, Expéd. Castelnau, Mamm., livr. 15, p. 34, pls. viii. fig. 7, x. fig. 1.—Type: "*Pteroderma perspicillatum* L." (=*Artibeus jamaicensis* Leach).

1856. *Artibæus* Gervais, op. cit. pp. 34–35, pl. ix. fig. 2.—Misspelling for *Artibeus*.

1856. *Dermanura* Gervais, op. cit. p. 36, pls. viii. fig. 4, ix. figs. 4, 4*a*, xi. fig. 3.—Type: *Dermanura cinereum* Gervais.

1892. *Artobius* Winge, E Museo Lundii, ii. pt. i. p. 3 (*cf.* p. 38).—Nomen emendatum.

Artibeus and *Uroderma*.—*Artibeus* differs from *Uroderma* in the following particulars:—

Skull short and broad. Rostrum conspicuously depressed; profile of skull, from front of sagittal crest to nasals, therefore much concave (text-fig. 43, on p. 213); height of rostrum at p^4 much less than width of skull at "postorbital" constriction (immediately behind postorbital processes or their rudiments). Bony palate shorter: distance from palation to front of incisors always less (generally very much less) than zygomatic width (text-fig. 43, on p. 213). Median backwardly extending portion of bony palate (behind last molar) shorter, not equal to the combined length (externally) of m^1 and m^2, often equal only to the length of m^1. Plane of anterior nasal opening more oblique than in *Uroderma*.

Inner upper incisors bifid, outer upper incisors simple. The cingulum of the lower canine terminates, on the inner side, about the level of the cutting-edges of the lower incisors, without forming a cusp-like projection (text-fig. 48, on p. 216). Cusp 4 (anterior cusp) of p^4 practically completely wanting (for this and the following dental characters see text-fig. 41, on p. 208). m^3 either quite rudimentary or, in most species, completely wanting; when present the tooth is situated postero-internally to m^2. As a consequence of the small size and postero-internal position of m^3, cusp 5 of m^2 is decidedly more lingual in position, occupying, precisely or very nearly, the middle of the posterior margin of the tooth. Cusp 2 of m_1 very strongly developed, rising as a high slender cone near the middle of the lingual margin of the tooth. In accordance with the rudimentary condition, or complete disappearance, of m^3, also m_3 is relatively smaller than in *Uroderma*, or, in certain species, entirely wanting.

No species of *Artibeus* has a narrow line of whitish fur down the middle of the upper side.

Artibeus and *Enchisthenes*.—*Artibeus* differs from *Enchisthenes* chiefly in the following respects:—

Cutting-edges of inner upper incisors bifid, not simple, pointed in the centre, without any trace of a median notch, as in *Enchisthenes*. m^3 rudimentary, situated postero-internally to m^2 or, most often, entirely wanting, not relatively large and situated direct behind m^2, as in *Enchisthenes*. m_3 very small, equal to $\frac{1}{8}$–$\frac{1}{12}$ of m^2 or entirely wanting; in *Enchisthenes* equal to about $\frac{1}{4}$ of m^2.—In no species of *Artibeus* is there any trace of a pointed projection on the inner margin of the tragus.

On the principal characters subject to specific variation.—(A) Skull.—In the fourteen species referred to the genus *Artibeus* in the present paper, three types of skull can be discriminated:—(1) The ordinary shape of the skulls, characteristic of all species but three, is that figured on p. 213 (text-fig. 43): rostrum moderately depressed, profile of nasals, from base to tip, very nearly horizontal (not slightly ascending), palate not shortened.—(2) In one species, *A. concolor*, the facial portion of the skull is

peculiarly shortened (see p. 233).—(3) In two species, *A. turpis* and *nanus*, the depression and flattening of the rostrum and heightening of the brain-case reach a climax, the rostrum being even very slightly bent upwards (profile of nasals rather a little ascending than horizontal), the palate shortened (see text-fig. 57, on p. 307).

(B) Teeth.—The species fall into two sections, probably forming two natural branches of the genus: those in which cusp 7 of m^1 is comparatively small, viz. *A. glaucus*, *watsoni*, *cinereus*, and *rosenbergi* (text-figs. 53, 54, 55); and those in which the cusp is comparatively large, viz. *A. concolor*, *planirostris*, *hirsutus*, *jamaicensis*, *toltecus*, *quadrivittatus*, *phæotis*, *aztecus*, *turpis*, and *nanus*; in their extremes (upper extreme of the former and lower extreme of the latter section) these two sections come very near to each other.—The rudimentary upper posterior and lower posterior molar (m^3 and m_3) can completely disappear; consequently the number of molars varies between $\frac{3}{3}$ (*A. concolor*, *planirostris*, *hirsutus*), $\frac{2}{3}$ (*A. jamaicensis*, *glaucus*, *watsoni*), and $\frac{2}{2}$ (*A. cinereus*, *rosenbergi*, *toltecus*, *quadrivittatus*, *phæotis*, *aztecus*, *turpis*, *nanus*).

(C) Tragus.—Inner margin thickened, outer margin sharp; cross-section, therefore, triangular. A notch in the outer margin, at level with base of inner margin; below this notch a square-shaped lobe, the upper and lower corners of which are produced into sharp points (this lobe is, in the following pages, called "the basal lobe"); above the notch a sharply projecting point (in the following pages, "the median projection"); outer margin, above the median projection, as a rule serrate; inner margin of tragus perfectly simple from base to tip. In so far the tragus of *Artibeus* does not differ appreciably from that of *Uroderma*.—The number of serrations on the upper half of the outer margin, above the median projection, is practically the same in all species but one, varying between 0 and 5; the variations within these limits is not specific, but individual; the usual number is 4, 3, or 2; sometimes the serrations are sharp, very often rounded, often reduced to very small nodules, this latter leading, in extreme cases, to complete obliteration of some, or all, of the serrations. In *A. concolor* I have found the number of serrations to be 7–8, but only one specimen has been available for examination.

(D) Nose-leaves.—In all species but two the front margin of the horseshoe is free; in *A. planirostris* it is sometimes, in *A. jamaicensis* often fastened down to, or even perfectly continuous with, the integument of the muzzle. In no species is the lancet so short as in *Enchisthenes harti*.

(E) Wing-structure.—Broadly speaking the wing-structure is the same in all species: fifth metacarpal averaging a trifle longer than third, fourth slightly the longest; second phalanx of third digit a little less than, or equal to, or a little more than $1\frac{1}{2}$ the length of the first phalanx.—The specific variation chiefly affects the proportionate length of the first phalanx of the third, fourth,

and fifth digits; in *A. fallax*, *hirsutus*, and *jamaicensis* (and *concolor* ?) the first phalanx is proportionately shorter, its indices being: third digit 281–298, fourth digit 245–260, fifth digit 186–201; in all other species the phalanx is proportionately longer, its indices being: third digit 327–357, fourth digit 279–304, fifth digit 217–240.

(F) Hairing on limbs and interfemoral.—In most species the posterior part of the interfemoral and the upper side of the tibia are very thinly haired or, at least on cursory inspection, almost naked; in a few species, especially *A. hirsutus*, *toltecus*, and *aztecus*, they are densely furred.

(G) Colour.—The specific variation in colour is extremely small, the individual variation considerable. As a means to separate the species of this genus colour-characters must, therefore, be used with great caution.—The general colour pattern is this: upper side some shade of brown, under side lighter; very often four facial stripes; often narrow whitish margins to the ears; sometimes white tips to the wings. Young (not full-grown) individuals darker and duller than adults.—In most, if not all, species there is a darker and a lighter colour extreme, as a rule (perhaps always) connected by several intermediate stages; the light-coloured extreme sometimes occurs in full-grown specimens with quite unworn teeth, *i. e.* in specimens which have evidently just reached the mature age, but I have never seen it in decidedly immature (not full-grown) individuals. A pair of white or whitish supraorbital and infraorbital stripes are very often present, but they vary, sometimes even in the same species (*A. jamaicensis*, and others), through all stages from complete absence to very strong development; as a rule (not always) they are strongest in lighter-coloured individuals. White tips to the wings are most conspicuous in the larger species (*A. planirostris*, *hirsutus*, *jamaicensis*), more indistinct or, as a rule, practically wanting in the smaller species.

(H) Size.—No less than ten species (*A. glaucus*, *watsoni*, *cinereus*, *rosenbergi*, *toltecus*, *quadrivittatus*, *phæotis*, *aztecus*, *turpis*, *nanus*) are, externally, approximately of equal size, the forearm varying between 36·5 and 47 mm. Three species (*A. planirostris*, *hirsutus*, *jamaicensis*) are noticeably, or much, larger: forearm 53·5–76 mm. One (*A. concolor*) is intermediate: forearm about 50 mm.

(I) Conclusions.—The principal, and in most cases the only reliable, differences between the species are cranial and dental. No specimen of *Artibeus* ought to be identified without a careful examination of the skull and teeth.

Species.—In 1878, Dobson catalogued 5 forms of *Artibeus*, viz. *A. planirostris*, *A. planirostris* var. *concolor*, *A perspicillatus*, *A. cinereus*, *A. quadrivittatus*. The total number of forms recognised in the present paper is 25 (14 species). The following table gives, in chronological order, a view of all the forms named, their type localities, their identification in Dobson's Catalogue, and their identification in this paper:—

Year.	Name.	Type locality.	Dobson's Catalogue.	This paper.
1821.	*A. jamaicensis* Leach.	Jamaica.	*A. perspicillatus.*	*A. jamaicensis jamaicensis.*
1821.	*Madatæus lewisii* Leach.	Jamaica.	*A. perspicillatus.*	*A. jamaicensis jamaicensis.*
1823.	*Phyllostoma lituratum* Licht.	Brazil.	Omitted.	*A. jamaicensis lituratus.*
1823.	*Phyllostoma planirostre* Spix.	Bahia.	*A. planirostris.*	*A. planirostris planirostris.*
1826.	*Phyllostoma superciliatum* Wied.	Rio de Janeiro.	*A. perspicillatus.*	? *A. jamaicensis lituratus.*
1826.	*Phyllostoma obscurum* Wied.	Rio de Janeiro.	? *A. planirostris.*	? *A. planirostris planirostris.*
1851.	*A. carpolegus* Gosse.	Jamaica.	*A. perspicillatus.*	*A. jamaicensis jamaicensis.*
1856.	*Dermanura cinerea* Gerv.	Brazil.	*A. cinereus.*	*A. cinereus cinereus.*
1860.	*Stenoderma toltecum* Sauss.	Mexico.	*A. cinereus.*	*A. toltecus toltecus.*
1865.	*A. fallax* Pet.	Guiana.	*A. planirostris.*	*A. planirostris fallax.*
1865.	*A. concolor* Pet.	Surinam.	*A. planirostris* var.	*A. concolor.*
1865.	*A. quadrivittatus* Pet.	Surinam.	*A. quadrivittatus.*	*A. quadrivittatus.*
1878.	*A. macleayi* Dobs. (ex Gray, MS.).	Cuba.	*A. perspicillatus.*	*A. jamaicensis parvipes.*
1878.	*A. grandis* Dobs. (ex Gray, MS.).	Unknown.	*A. perspicillatus.*	*A. jamaicensis lituratus.*
1889.	*Dermanura eva* Cope.	St. Martins, W. I.		*A. jamaicensis jamaicensis.*
1890.	*A. coryi* All.	St. Andrew's I.		*A. jamaicensis jamaicensis.*
1893.	*A. glaucus* Thos.	Chanchamayo, Peru.		*A. glaucus.*
1897.	*A. palmarum* All. & Chapm.	Trinidad.		*A. jamaicensis palmarum.*
1897.	*A. intermedius* All.	S. José, Costa Rica.		*A. jamaicensis palmarum.*
1897.	*A. rosenbergi* Thos.	Cachavi, N. Ecuador.		*A. rosenbergi.*
1899.	*A. femurvillosum* Bangs.	S. Marta, Colombia.		*A. jamaicensis palmarum.*
1901.	*A. watsoni* Thos.	Chiriqui.		*A. watsoni.*
1902.	*Dermanura rava* Miller.	S. Javier, N. Ecuador.		*A. toltecus ravus.*
1902.	*Dermanura phæotis* Miller.	Yucatan.		*A. phæotis.*
1902.	*A. hercules* Rehn.	E. Peru.		? *A. planirostris fallax.*
1902.	*A. parvipes* Rehn.	Cuba.		*A. jamaicensis parvipes.*
1904.	*A. rusbyi* All.	Yungas, Bolivia.		*A. jamaicensis lituratus.*
1904.	*A. insularis* All.	St. Kitts, W. I.		*A. jamaicensis jamaicensis.*
1904.	*A. yucatanicus* All.	Chichen Itza, Yucatan.		*A. jamaicensis yucatanicus.*
1906.	*Dermanura jucundum* Ell.	Vera Cruz.		*A. phæotis.*
1906.	*A. planirostris trinitatis* K. A.	Trinidad, W. I.		*A. planirostris trinitatis.*
1906.	*A. planirostris grenadensis* K. A.	Grenada, W. I.		*A. planirostris grenadensis.*
1906.	*A. hirsutus* K. A.	Michoacan, Mex.		*A. hirsutus.*
1906.	*A. jamaicensis æquatorialis* K. A.	Zaruma, S. Ecuador.		*A. jamaicensis æquatorialis.*
1906.	*A. jamaicensis præceps* K. A.	Guadeloupe, W. I.		*A. jamaicensis præceps.*
1906.	*A. cinereus bogotensis* K. A.	Bogota, Colombia.		*A. cinereus bogotensis.*
1906.	*A. aztecus* K. A.	Morelos, Mex.		*A. aztecus.*
1906.	*A. turpis* K. A.	Tabasco, Mex.		*A. turpis.*
1906.	*A. nanus* K. A.	Guerrero, Mex.		*A. nanus.*
1907.	*Uroderma validum* Ell.	Cayenne.		*A. planirostris fallax.*

Range.—From S. Brazil, Paraguay, and Bolivia, to Sinaloa in North Central Mexico, including the whole of the West Indies.

Geographical review of the species and subspecies.—The subjoined geographical review is based almost exclusively on the material examined by myself. An asterisk before a technical name indicates that the type-locality of the species or subspecies falls within the region under consideration.

Paraguay.—*A. jamaicensis lituratus.*

Brazil.—*A. concolor* (Para, Upper Amazonas).—**A. planirostris planirostris* (Bahia, Matto Grosso, Pernambuco, Maranhão, Para).—*A. planirostris fallax* (Para).—**A. jamaicensis lituratus* (Sta. Catharina, Parana, Minas Geraes, Bahia, Para).—**A. cinereus cinereus* (Para).—*A. quadrivittatus* (Pernambuco).

Peru.—*A. planirostris (? fallax).*—**A. glaucus.*

Ecuador.—**A. jamaicensis æquatorialis.*—*A. jamaicensis lituratus.*—**A. rosenbergi.*—**A toltecus ravus.*

Guiana.—**A. concolor.*—**A. planirostris fallax.*—*A. cinereus cinereus.*—**A. quadrivittatus.*

Venezuela.—*A. planirostris planirostris.*—*A. planirostris fallax* (Lower Orinoco).—*A. jamaicensis palmarum.*—*A. cinereus cinereus.* —*A. cinereus bogotensis* (N.W. Venezuela).—*A. rosenbergi.*

Trinidad.—**A. planirostris trinitatis.*—**A. jamaicensis palmarum.*—*A. cinereus cinereus.*

Tobago.—*A. planirostris trinitatis.*—[*A. jamaicensis palmarum.*]

Grenada.—**A. planirostris grenadensis.*—[*A. jamaicensis palmarum.*]

St. Vincent.—*A. jamaicensis palmarum.*

Dominica, Guadeloupe.—**A. jamaicensis præceps.*

Colombia (excluding Panama).—*A. jamaicensis æquatorialis* (Cali).—*A. jamaicensis lituratus.*—**A. cinereus bogotensis.*

Central America (including Panama).—*A. planirostris planirostris* (whole region).—*A. jamaicensis jamaicensis* (whole region). —*A. jamaicensis palmarum* (whole region).—**A. watsoni* (Panama, Nicaragua).—*A. toltecus toltecus* (Costa Rica, Nicaragua, Guatemala).

Belize and Yucatan.—**A. jamaicensis yucatanicus.*—**A. phæotis.*

Mexico (excluding Yucatan).—*A. planirostris planirostris* (Chiapas, Guerrero).—**A. hirsutus* (Michoacan, Colima, Jalisco). —*A. jamaicensis jamaicensis* (Campeche, Chiapas, Tehuantepec, Oaxaca, Morelos, Vera Cruz).—*A. jamaicensis palmarum* (Oaxaca, Vera Cruz, Jalisco).—**A. toltecus toltecus* (Oaxaca, Vera Cruz, Jalisco, Durango).—*A. phæotis* (Vera Cruz).—**A. aztecus* (Morelos). —**A. turpis* (Tabasco).—**A. nanus* (Guerrero, Vera Cruz, Colima, Sinaloa).

Cuba (perhaps including Key West).—**A. jamaicensis parvipes.*

St. Andrews, Old Providence, Jamaica, San Domingo, Porto Rico, St. Martins, St. Kitts.—**A. jamaicensis.*

Proposed subdivisions of the genus.—Gervais (1856, *l. s. c.*) was

the first to make an attempt to subdivide *Artibeus* into three genera characterised by their number of molars, as follows:—

(1) *Artibœus*, molars $\frac{3}{3}$; species three, viz. "*A. jamaicensis*," according to the figure of the teeth clearly not *A. jamaicensis* Leach, but *A. planirostris* Spix; the localities given by Gervais, "de la Jamaïque, de la Guadeloupe et de Cuba" are undoubtedly wrong; further, "*A. lineatus*" (= *Vampyrops lineatus*), and "*A. undatus*" (= *Stenoderma rufum*);

(2) *Pteroderma*, molars $\frac{2}{3}$; species one, "*Pt. perspicillatum*," "répandue au Pérou, au Brésil, et à la Guayane"; this is, as shown by the figures of the teeth, *A. jamaicensis* Leach (sensu lato);

(3) *Dermanura*, molars $\frac{2}{2}$; species one, "*D. cinerea*," i. e. *A. cinereus* of the present paper.

In July 1865 *, Peters divided *Artibeus* into two "groups" (subgenera), viz.:—

(1) *Artibeus* Leach, molars $\frac{3}{3}$ or $\frac{2}{3}$; species four: "*A. perspicillatus* Geoff." (i. e. *A. jamaicensis lituratus* of this paper), "*A. jamaicensis* Leach" (i. e. *A. jamaicensis jamaicensis*), *A. fallax* (i. e. *A. planirostris fallax*), and *A. concolor*;

(2) *Dermanura* Gervais, molars $\frac{2}{2}$; species three: *D. cinerea*, ? *D. tolteca*, and *D. quadrivittata*.

Peters placed the species with $\frac{3}{3}$ and $\frac{2}{3}$ molars together in one group, "weil dieser kleine Zahnstumpf allein kein Grund sein kann, Arten, die sonst im Schädel- und Zahnbau, so wie in jeder anderen Beziehung ganz mit einander übereinstimmen, generisch von einander zu trennen." But he was not quite consistent; if "dieser kleine Zahnstumpf" (m^3) is not sufficient reason to separate, as different groups, species with $\frac{3}{3}$ and $\frac{2}{3}$ molars, it is difficult to see why the other, equally rudimentary tooth (m_3) furnishes a valid reason to separate, as a distinct section, the species with $\frac{2}{2}$ molars from those with $\frac{2}{3}$ molars. From Peters's standpoint there would seem to be two alternatives only, either not to subdivide the genus, acknowledging that the presence or absence of a perfectly rudimentary tooth is a character of specific, but not of subgeneric or generic importance, or to subdivide it into three groups.—Peters himself has probably felt the inconsistency of his classification. At all events, in spite of his own argument, that the species with $\frac{3}{3}$ and $\frac{2}{3}$ molars "sonst im Schädel- und Zahnbau, so wie in jeder anderen Beziehung ganz mit einander übereinstimmen," he, only a few months later †, proposed a new subgeneric name, *Uroderma*, for the species with $\frac{3}{3}$ molars. And, finally, in June 1866 ‡, he evidently regarded the sections no more as subgenera, but as genera.—Thus Peters had now, in 1866, practically adopted Gervais's view, that *Artibeus* is to be divided into three genera, according to the number of molars, viz.:—

(1) *Uroderma* Peters 1865 (synonym: *Artibœus* Gervais 1856,

* Peters, MB. Akad. Berlin, 13 July 1865, p. 356, footnote.
† Peters, MB. Akad. Berlin, 13 Nov. 1865, p. 588, footnote.
‡ Peters, MB. Akad. Berlin, 25 June 1866, p. 394.

not *Artibeus* Leach 1821), molars $\frac{3}{3}$; species *U. bilobatum* Pet., "*U. fallax* Pet.," and *U. concolor*;

(2) *Artibeus* Leach 1821 (synonym: *Pteroderma* Gervais 1856), molars $\frac{2}{3}$; species "*A. perspicillatus* Geoff." and "*A. jamaicensis* Leach";

(3) *Dermanura* Gervais 1856, molars $\frac{2}{2}$; species as above.

By this arrangement Peters, as already said, had practically gone back to Gervais's standpoint; these words are true also in the sense that his arrangement is in no respect an improvement upon the older one; both of them are typical examples of artificial classification. Gervais selected as the *only* leading character for his subdivisions the presence or absence of a vanishing tooth; Peters did precisely the same. Gervais proved the fallacy of the taxonomic character selected by him, in so far as he placed together in one "genus" (*Artibæus*) a true *Artibeus*, a *Vampyrops*, and a *Stenoderma*, because they, though different in many important respects, happen to have $\frac{3}{3}$ molars; and, on the other hand, separated into two genera (*Artibæus* and *Pteroderma*) two species so closely related as to be sometimes extremely difficult to distinguish (*A. planirostris* and *jamaicensis*). Peters proved the same, by putting together in one "genus" (*Uroderma*) two generically widely different forms (*U. bilobatum* and "*A. fallax*"), because they both happen to have $\frac{3}{3}$ molars, at the same time separating into two "sections" or genera "*A. fallax*" and *A. jamaicensis*, which differ in next to nothing but the presence or absence of a rudimentary tooth.

In the description of the genus *Uroderma* (above, p. 217) I have given my reasons for keeping *U. bilobatum* and *thomasi* generically separate from *Artibeus*. The next question, therefore, is, if, having removed these two species from *Artibeus*, it might be convenient to divide it into three subgenera or genera, according to the number of molars. Also in this modified shape I am unable to accept Peters's proposal, for the following reasons:—

(1) The series of species here referred to the genus *Artibeus* form one natural group the members of which are perfectly similar in all essential cranial, dental, and external characters.

(2) *A. planirostris* has $\frac{3}{3}$ molars; but of 73 skulls examined of this species, two lack m^3 on one side, two on both sides, and one of these latter also lacks m_3 on one side. *A. hirsutus* has $\frac{3}{3}$ molars; but of 8 skulls, two lack m^3 on one side. *A. jamaicensis* has $\frac{2}{3}$ molars; but of 182 skulls, two lack m_3 on one side, four on both sides. *A. rosenbergi* has $\frac{2}{2}$ molars, but of the only two individuals known, the one has an m_3 on one side. *A. toltecus* has $\frac{2}{2}$ molars, but of 26 skulls, one has an m_3 on one side.—None of the individuals here referred to are aberrant on account of very young or very high age. Some of them, it will be noticed, have lost the rudimentary molar * (m^3 or m_3) which is normally present in

* It is hardly necessary to say that in all the aberrant individuals referred to above m^3 or m_3 (or both) are *entirely* lost, *i. e.* no trace of their alveoli has been left.

individuals of their species; others, in which the absence of m_3 is normal, show, individually, a tendency to reversion to the more primitive stage in which this small tooth was present.—A character which is not only in itself very insignificant, but not even individually perfectly constant is evidently unsuitable for the separation of groups of generic or subgeneric rank.

(3) By subdividing *Artibeus* according to the number of molars, the "genera" or "subgenera" would be these three:—molars $\frac{3}{3}$, *A. concolor*, *planirostris*, *hirsutus*; molars $\frac{2}{3}$, *A. jamaicensis*, *glaucus*, *watsoni*; molars $\frac{2}{2}$, *A. cinereus*, *rosenbergi*, *toltecus*, *quadrivittatus*, *phæotis*, *aztecus*, *turpis*, *nanus*.—But *A. planirostris* is much more closely related to *A. jamaicensis*, which is placed in a different genus or subgenus, than to *A. concolor*, with which it is associated in one group. *A. glaucus* and *watsoni* are put together with *A. jamaicensis*, solely because they like this latter have a rudimentary m_3, but in all other respects they are much more closely related to *A. cinereus*, which has permanently lost m_3. The eight species with $\frac{2}{2}$ molars constitute a strangely heterogeneous section; *A. cinereus* is nearer to *A. glaucus* and *watsoni* than to any of the forms with $\frac{2}{2}$ molars with which it is put together; *A. rosenbergi* is unique in the genus in the strong reduction of m^2; *A. toltecus*, *quadrivittatus*, and *aztecus* are, probably, rather more closely allied to *A. jamaicensis* than to any species with $\frac{2}{2}$ molars; and, finally, *A. turpis* and *nanus* form a small natural group characterised by the unusually strongly depressed and slightly upwardly directed cranial rostrum.—From this it will be evident that a subdivision of the genus based on the presence or absence of m^3 or m_3 would give only a very distorted view of the mutual affinities of the species.

(4) A study of the species of *Artibeus* has led the writer of this paper to the conclusion that they, probably, fall into two natural groups, which have nothing to do with the hitherto proposed subdivisions of the genus, viz., those species in which cusp 7 of m^1 is relatively small (*A. glaucus*, *watsoni*, *cinereus*, and *rosenbergi*), and those in which it is relatively large (all the other species). This point, which has more theoretical than practical interest, will be discussed in the last section of the present paper, pp. 314–316.

Artibeus concolor Pet.

1865. *Artibeus concolor* Peters, MB. Akad. Berlin, p. 357.—Paramaribo (Surinam).
1878. *Artibeus planirostris* (not Spix), var. α, Dobson, Cat. Chir. Brit. Mus. p. 518.—Upper Amazons.
1892. *Artibeus concolor* Pet., Thomas, Ann. & Mag. N. H. (6) x. pp. 409–410, footnote (Nov. 1892).—Some cranial measurements of the type.
1901. *Artibeus concolor* Pet., Thomas, Ann. & Mag. N. H. (7) viii. p. 191 (Sept. 1901).—Para.

Diagnosis.—An *Artibeus* with $\frac{3}{3}$ molars, the maxillary tooth-row measuring about 7·2, the forearm about 50 mm.

Teeth.—The teeth of *A. concolor* are proportionately very much smaller than in the two other species with $\frac{3}{3}$ molars, *A. plani-*

rostris and *hirsutus*. *A. concolor* is externally not very inferior in size to a small *A. hirsutus* or *A. planirostris trinitatis*; the forearm in the only specimen examined of *A. concolor* measures 50 mm., in the smallest *A. hirsutus* 53·7 mm.; but the length of the maxillary tooth-row is in *concolor* only 7·2 mm., in the smallest-toothed *A. hirsutus* 9·5 mm. A comparison with *A. planirostris* shows a similar contrast.—In structure the teeth of *A. concolor* do not differ from those of *A. planirostris* and *hirsutus*.

Skull.—Rostrum (probably owing to small size of teeth) relatively much shorter than in *A. hirsutus* or *planirostris*. The ratio between the length of the rostrum (from front of sagittal crest to front of alveolus of a median incisor) and the length of the brain-case (from front of sagittal crest to median posterior point of lambdoid crest) is in *concolor* 68 : 100, in *hirsutus* and *planirostris* 83 : 100; or, expressed in another way, the length of the nasal region, from front of sagittal crest to front of nasal bones, is in *A. concolor* equal to the least interorbital width of the skull, in *hirsutus* and *planirostris* equal to $1\frac{1}{2}$ this width. The rostrum in *A. concolor* is a trifle less depressed than in *hirsutus* and *planirostris*, but the difference in this respect is inconspicuous.—The short rostrum makes, of course, the total length of the skull much smaller: in *concolor* 22·4, in the shortest-skulled *hirsutus* available 26·8 mm., although, as mentioned above, the animal in external dimensions is only a trifle larger than *concolor*. The difference in the length of the forearm, between *concolor* and a small *hirsutus*, is only 3·7 mm., but in the length of the skull 4·4 mm.—In every other respect the skull of *concolor* is similar to that of *planirostris* and *hirsutus*.

Nose-leaves.—Front margin of horseshoe free; both front and lateral margins quite plain (not crenulate). It remains to be ascertained if these characters are perfectly constant (compare the individual variation in *A. planirostris*, *hirsutus*, and *jamaicensis*).

Tragus.—7 or 8 sharp, but short, serrations on the upper half of the outer margin, above the median projection; the highest number of serrations found in any other species of *Artibeus* is 5. A large series of *A. concolor* will, no doubt, show some variation both in the number and shape of the serrations.

Hairing on limbs and interfemoral.—Essentially as in *A. planirostris*: upper side of proximal half of forearm, upper side of interfemoral (the extreme posterior margin excepted) and of femur (the distal part excepted) densely haired.

Colour.—Upper side from shoulders backward yellowish brown (rather browner than Ridgway's "wood-brown"); base of hairs almost ecru-drab. In front of the shoulder region the darker hair-tips are short or altogether wanting, exposing the white or yellowish-white ground-colour of the fur. Under side light greyish drab. Supraorbital stripes distinct, infraorbital stripes almost obsolete. There seems to be no light margins to the ears.

Tips of wings (region of third phalanx of third digit) lighter-coloured.

The above description is taken from an adult female with unworn teeth, preserved in alcohol. There can scarcely be any doubt that the specimen represents a "light phase"; the type in the Berlin Museum is, judging from Peters's short description, considerably darker. Similar contrasts in the coloration of the fur occur in many other species of *Artibeus*.

Measurements.—On p. 246.

Specimens examined.— ♀ ad. (alc.), Para; with skull; British Museum.—I have been unable to find the specimen (♀ ad., Upper Amazons) catalogued by Dobson (*l. s. c.*) as *A. planirostris* var. α.

Range.—Surinam; Para; Upper Amazons (probably).

Peters's *A. concolor*, 1865.—Type locality: Paramaribo, Surinam. *A. concolor* was described by Peters as being in every respect similar to *A. fallax* [i. e. *A. planirostris fallax* of the present paper], but much smaller; molars $\frac{3}{3}$, m^3 in position and relative size as in *A. fallax*; "Unterarm" 47 mm. (Peters probably measured the radius, not the "forearm"), tibia 18 mm. There are no measurements of the skull in the original description, but according to Prof. Matschie (in a letter quoted by Oldfield Thomas in 1892, *l. s. c.*) the maxillary tooth-row measures 7·5 mm., the maxillary width across m^1–m^1 9·9 or 10 mm.—These details seem to exclude all doubt as to the identification of *A. concolor*.

From the above description of *A. concolor* it will be evident that Dobson was mistaken in regarding this species as a mere variety of *A. planirostris*; it is far more different from *A. planirostris* than is this latter from *A. jamaicensis* ("*A. perspicillatus*" in Dobson's Catalogue).

A. concolor seems to be very rare in collections, the type in the Berlin Museum, two specimens in the British Museum, and one in the Para Museum being, to my knowledge, the only examples on record.

Artibeus planirostris Spix.

Diagnosis.—Molars $\frac{3}{3}$. Maxillary tooth-row 9·8–12 mm. Forearm 55–73 mm. Tibia and distal part of interfemoral so short-haired as to appear almost naked. Colour of fur of upper side not drab.

Teeth.—The teeth of this species have been described in detail and figured above, pp. 207–212, text-fig. 41.

The rudimentary m^3, situated postero-internally to m^2, partly pressed into a sharp angular emargination in the posterior margin of this latter, between its cusps 5 and 7, is very rarely wanting in adult individuals. 67 skulls of fully adult individuals have been examined, representing all the races of *A. planirostris* recognised in this paper; in two skulls (*A. p. fallax*, ♂ ad. and ♀ ad., British Guiana, teeth unworn and slightly worn, B.M nos. 6.4.8.7 and 8) is m^3 present on one side, while the tooth

and its alveolus are wanting on the other side; in two skulls (*A. p. fallax*, ♀ ad., British Guiana, teeth almost unworn, B.M. no. 6.4.8.11; and *A. p. planirostris*, ♀ ad., Bahia, teeth unworn, U.S. N. M. no. 102457) is m^3 entirely wanting on both sides, and in one of these latter skulls (102457) also m_3 is entirely lost on one side. Thus, only 3 per. cent. of the large series of skulls of adults examined have entirely lost m^3 on both sides.

It is of some importance to emphasise that the disappearance of m^3 in *A. planirostris* is a very rare individual aberration, inasmuch as the presence of this small tooth is in many cases the only character by which *A. planirostris* can be safely discriminated from *A. jamaicensis*.

Tragus.—In most individuals there are 4 or 5 small serrations on the outer margin of the tragus, above the median projection; the serrations may be sharp, but as a rule they are more or less rounded off, often reduced to inconspicuous nodules, sometimes almost obliterated. The variation is quite individual.

Nose-leaves.—According to Dobson, the anterior margin of the horseshoe in *A. planirostris* is "free, separated from the muzzle, straight, unnotched," and the author of the British Museum Catalogue of Chiroptera lays much stress on this character as a difference between *A. planirostris* and *A. jamaicensis* ("*A. perspicillatus*"). In a majority of individuals of *A. planirostris* the front margin of the horseshoe is distinctly "free," but there is every intermediate stage from this condition, through a margin clearly "bound down," though still more or less projecting, to a margin so completely fastened down as to be almost continuous with the integument of the muzzle. As a similar (or, if anything, still greater) variation in this respect occurs in *A. jamaicensis*, the character is quite useless for a discrimination of these two species. —The margin of the horseshoe is sometimes simple, sometimes crenulate in front, sometimes crenulate all round; the crenulation occasionally extends to the margins of the lancet.—The lateral margins of the horseshoe are not rarely bent up so as to form a fold, suggesting the condition characteristic of *Uroderma*.

Hairing on limbs and interfemoral.—The proximal half or two-thirds of the forearm, the metacarpal of the pollex, the upper side of the femur (the tip, as a rule, excepted), and the base of the interfemoral next to the body and the femur, are densely haired. The tip of the femur and the whole of the tibia covered with so short and sparse hairs as to appear almost naked. The toes, from the tarsus to the base of the claws, clothed with rather long, coarse hairs.

Colour.—Young individuals:—Upper side from shoulders backward dark and dull smoky brown, this colour confined to the distal third or fourth of the hairs; base of hairs slate. On the anterior part of the upper side, from the shoulders forward, the hair-bases are distinctly lighter, almost smoke-grey. Under side dark smoke-grey, with a peculiar mottled appearance, due to the very short, almost greyish-white tips to the hairs. Tips of wings

(region of third phalanx of third digit) more or less whitish. A pair of whitish or greyish-white supraorbital stripes, as a rule indistinct, sometimes altogether wanting.—This is the usual colour in young, not full-grown individuals; it never occurs in the mature *A. planirostris*.

At a somewhat later stage, the colour of the hinder back is less smoky, more approaching dark brown in tinge, with the hair-bases almost drab. The rest of the upper side, from the shoulders forward, much of the same general colour, but the dark hair-tips shorter, the hair-bases considerably lighter, varying from wood-brown to greyish white; very often the hair-tips in this region of the upper side are so short as to more or less (or almost completely) expose the light ground-colour, in which case there, consequently, is a contrast between the anterior and posterior part of the upper side. The under side essentially as in immature individuals, though as a rule a shade lighter. Supraorbital stripes often completely wanting, often rather indistinct, rarely strongly developed; there is sometimes, though rarely, an indication of infraorbital stripes.—This is the commonest colour in the adult *A. planirostris*, very often occurring also in specimens with much worn teeth.

A considerably lighter colour is acquired by some adult individuals:—Upper side approaching Prout's brown, base of hairs almost ecru-drab. Anterior portion of upper side, from shoulders forward, as a rule noticeably lighter, owing to the dark hair-tips being shorter and the wood-brown hair-bases showing through. Under side almost drab, with short greyish-white tips to the hairs. Supraorbital stripes as a rule well marked, often strongly developed, wood-brown or whitish; there is often a more or less definite indication of infraorbital stripes.—This stage evidently represents the "light phase" so common in many bats: I never saw a young *A. planirostris* in this colour-stage; it is apparently confined to the fully adult age, and it is only acquired by a limited number of individuals.

Thus there are three stages of colour: a dark and dull smoky brown, a dark brown, and a Prout's brown; the two former come very near to each other, the third, when fully developed, is different at a glance. The first is confined to the immature age; the second is characteristic of a majority of adults; the third seems to occur only in some fully adult and aged individuals; it is especially common in the largest race, *A. p. fallax*, but not rare in *A. p. planirostris* and *trinitatis*.

Range.—From Central Brazil (Bahia, Matto Grosso) and S. Bolivia (Caiza) to S. Mexico (Chiapas, Guerrero), including the Venezuelan coast islands (Trinidad, Tobago) and the southern Windward Islands (Grenada), but excluding the rest of the West Indies.

Remarks.—By the combination of the five characters given in the brief diagnosis above, p. 234, *A. planirostris* (all races) is readily distinguishable from all other species of the genus. The

first character (molars $\frac{3}{3}$) excludes all species, except *A. concolor* and *hirsutus*; the addition of the second and third characters (large skull and teeth, large external dimensions) excludes *A. concolor*; the addition of the fourth and fifth (tibia and distal interfemoral almost naked, general colour of fur of upper side not drab) exclude also *A. hirsutus*.

Forms.—Four races of *A. planirostris* are described below: *A. p. planirostris*, *trinitatis*, *grenadensis*, and *fallax*. The three former come very near to each other, the fourth is rather more completely differentiated, but cannot be specifically separated.

Artibeus planirostris planirostris Spix.

1823. *Phyllostoma planirostre* Spix, Simiarum et Vespertilionum Brasiliensium species novæ, p. 66, pl. xxxvi. fig. 1.—Bahia.
1826. ? *Phyllostoma obscurum* Wied, Beitr. Naturg. Bras. ii. pp. 203–205.—Rio de Janeiro.
1840. *Phyllostoma perspicillatum* (partim, nec L.) Wagner, Schreber's Säugthiere, Suppl. i. pp. 403–405.—Re-description of Spix's type of *Ph. planirostre*.
1865. *Phyllostoma planirostre* Spix, Peters, MB. Akad. Berlin, p. 587.—Spix's type of *Ph. planirostre* re-examined.
1878. *Artibeus planirostris* Spix (partim), Dobson, Cat. Chir. Brit. Mus. pp. 515–517.
1901. *Artibeus planirostris* Spix, Robinson & Lyon, Proc. U.S. Nat. Mus. xxiv. p. 148.—La Guaira, Venezuela (specimens examined).
1904. *Artibeus intermedius* All. (errore), J. A. Allen, Bull. Am. Mus. N. H. xx. Art. iv. p. 79 (29 Febr. 1904); *cf.* Allen, t. c. Art. xx. p. 233 (29 June 1904).—Chiriqui.
1904. *Artibeus planirostris* Spix, Thomas, P. Z. S. 1903, ii. p. 234 (1 April 1904).—Chapada, Matto Grosso (specimen examined).

Diagnosis.—Total length of skull 27·5–30 mm. (average 28·5 mm.); zygomatic width 16·8–18·5 mm. (average 17·6 mm.); forearm 57·8–65·2 mm. (average 61·8 mm.).

A. p. planirostris and *trinitatis.*—*A. p. planirostris* can only be discriminated from its nearest relative, *A. p. trinitatis*, by average characters. In *A. p. planirostris* the forearm and metacarpals average about 4 mm., the tibia 1·5 mm. longer; the ears are, generally, a little larger; the average difference in the size of the skull and teeth is very small.—For further details see the table, p. 246.

Specimens from different localities.—In the subjoined comparative table of measurements (p. 240) I have divided the material examined into three groups, viz. specimens from Brazil, Venezuela, and S. Mexico. The table shows that the size of the skull and teeth and the external dimensions are identical in individuals from these three regions.

Specimens examined.—26 specimens (12 skins) and 20 skulls, from the following localities:—

British Museum:—Brazil: Chapada, Matto Grosso, 700–900 m. (1); Pernambuco (2); S. Lourenço, Pernambuco, 28–60 m. (8); Igarapé, Assii, Para, 50 m. (2); "Brazil" (1).—10 skulls, from all the localities enumerated.

U.S. National Museum*:—Brazil: Bahia (1); Anilo, Maranhão

* U.S. N. M. nos. 100201, 100203, 102457, 102894–96, 104565, 104567–69, 104574, 126554.

(5).—Venezuela: Macuto, La Guaira (3).—S. Mexico: Palenque, Chiapas (2); Papáyo, Guerrero (1).—10 skulls, representing all these localities.

Range.—From Central Brazil (Bahia, Matto Grosso) to S. Mexico (Chiapas, Guerrero). As yet no record from Guiana (see *A. p. fallax*).

Spix's *Phyllostoma planirostre*, 1823.—Type locality: "in suburbiis Bahiæ." From Spix's description and figure so much only can be decided with certainty that his *Ph. planirostre* is a large species of *Artibeus*. There being only two large species known, the point to be settled is this: is Spix's type the form called *A. planirostris* in the present paper ($\frac{3}{3}$ molars), or is it *A. jamaicensis* ($\frac{2}{3}$ molars). Both of these species occur in the Bahia region.—Three authors, Wagner in 1840, Peters in 1865, and Dobson in 1878, have discussed this question and arrived at different conclusions:—

Wagner's description of "*Phyllostoma perspicillatum*" (1840, *l. s. c.*) was based on what he considered Spix's types of *Ph. planirostre*:—"Von seinem *Phyllostoma planirostre* hat Spix 3 Exemplare in Weingeist hinterlassen," he writes; and "die nachstehende Beschreibung ist nach den Spix'schen Exemplaren entworfen." The only additional information of importance contained in Wagner's description is this: "Backenzähne finden sich $\frac{4}{5}$ vor," *i. e.* Wagner found only $\frac{2}{3}$ molars in the presumed types.—From this it might be inferred that Spix's *Ph. planirostre* is Leach's *A. jamaicensis*.

Peters writes (1865, *l. s. c.*): "Nach Untersuchung des einzigen Originalexemplars in Weingeist [von *Ph. planirostre*] kann ich nur die Uebereinstimmung desselben mit *Ph. perspicillatum* Geoffroy bestätigen," and found the specimen which he considered the type to have $\frac{2}{3}$ molars.—From this, again, it would seem that *Ph. planirostre* Spix (1823) is a synonym of *A. jamaicensis* Leach (1821), this latter being the only large species of the genus with $\frac{2}{3}$ molars. There is, it will be noticed, a discrepancy between Wagner and Peters with regard to the number of typical specimens; according to Wagner there are three, according to Peters one only.

Dobson (1878, *l. s. c.*), though he had no opportunity of examining the type (or types) of *Ph. planirostre*, rejected Peters's identification on account of the following words in Spix's original description: "vexillum nasale . . . . inferius lateraliter et antice libere pendens"; he regarded this statement of Spix, that the horseshoe is "free" in front, as decisive evidence that *Ph. planirostre* is the large species with $\frac{3}{3}$ molars, not the large species with $\frac{2}{3}$ molars; and the difficulty that, according to Peters, the type of *planirostre* has $\frac{2}{3}$ molars only, he overcame by arguing that the type might be immature, or very old, or in this respect abnormal.—But the fact is, it must be said at once, that the condition of the front margin of the horseshoe is thoroughly unreliable

as a differential character between the two large species of *Artibeus* (see pp. 235 and 253 of this paper), so that Dobson's way of settling the question was exceedingly unsafe. That, nevertheless, the conclusion was right is proved by the following information kindly forwarded to me by Dr. W. Leisewitz, Munich (in litt., 15 Sept. 1906):—

The register of the Munich Museum ("Zoologische Sammlung des Bayerischen Staates") for 1830 has this entry: "No. 65, *Phyllostoma planirostrum* (Sp.), 1 Exemplar"; the specimen is labelled "Bahia, Spix coll."; this settles the question as to the number of typical specimens; there is one only. When Wagner mentioned three typical examples, the reason was, I am informed by Dr. Leisewitz, probably that Spix brought back from Bahia not only one *Ph. planirostre* but also two "*Ph. perspicillatum*" (i. e. *A. jamaicensis lituratus* of the present paper), both of which latter are also in the Munich Museum; Wagner evidently considered all three examples to be one species (*A. planirostris* and *jamaicensis* are difficult to discriminate externally), and his statement that "*planirostre*" has $\frac{2}{3}$ molars is undoubtedly taken from one of the two *A. jamaicensis*, not from the true type of *Ph. planirostre*.—This latter has, Dr. Leisewitz writes, a distinct m^3 on both sides of the upper jaw; the anterior margin of the horseshoe is (as said by Spix) free; the forearm measures 58·5, third metacarpal 57, first phalanx of third digit 17·7, second phalanx of third digit 28·5 mm. This settles, beyond all doubt, the identification of Spix's type: it is *Ph. planirostris planirostris* of this paper, not *A. jamaicensis lituratus* (molars $\frac{2}{3}$, forearm 64–76 mm.), the only other large form of *Artibeus* known from Bahia.—There remains Peters's wrong statement about the number of molars of the "type" ($\frac{2}{3}$ according to Peters, not $\frac{3}{3}$ as in fact is the case): On Oct. 17, 1865, Siebold sent Spix's Chiroptera to Peters for inspection, among these the type of *Ph. planirostre* and one example of "*A. perspicillatus* L." (*A. jamaicensis lituratus* Licht.); in the list accompanying the specimens, Siebold unfortunately entered these two bats as "2 *Phyll. planirostre*, Bahia." When, therefore, Peters wrote that Spix's type of *Ph. planirostre* has $\frac{2}{3}$ molars only, he no doubt examined the wrong specimen (*A. j. lituratus*), not the true type; this explanation is further strengthened by the fact that the true type (Dr. L. writes) shows no trace of having had the mouth opened for examination of the molars; finally, when Peters wrote that there is only "ein einziges Originalexemplar," it was, *from his standpoint*, a mistake, for on sending Spix's bats back to Munich he wrote (letter dated 10 Dec. 1865): "2 St. *Artibeus perspicillatus* Geoffr.=*Phyll. planirostre* Spix! Original."

As a final result: there is one type only of Spix's *Ph. planirostre* still in the collection of the Munich Museum; this specimen has $\frac{2}{3}$ molars, and the forearm 58·5 mm.: both facts are decisive evidence that it is the bat called *A. p. planirostris* in this paper; Wagner's and Peters's statement that it has $\frac{2}{3}$ molars is a

mistake, due to their having examined the teeth not of the true type, but of specimens of *A. jamaicensis lituratus* also collected by Spix at Bahia. It has been of importance, from a purely nomenclatural point of view, to have this question definitely settled; if Wagner and Peters were right, Spix's *Ph. planirostre* would have been a synonym of *A. jamaicensis lituratus*, whereas the species hitherto called *A. planirostris* would have had to stand as *A. fallax* Pet.

Maximilian of Wied's *Phyllostoma obscurum*, 1826.—Type from "Villa Viçosa am Flusse Peruhype," *i. e.* Parahyba, province of Rio de Janeiro. Judging from the description there can only be the question whether this is *A. planirostris planirostris* or *A. jamaicensis lituratus*. The number of "Backenzähne im Oberkiefer" is

Measurements of Artibeus planirostris planirostris.

	Brazil (Matto Grosso, Bahia, Pernambuco, Maranhão, Para). 16 adults, 11 skulls.		Venezuela (La Guaira). 3 adults, 3 skulls.		S. Mexico (Chiapas, Guerrero). 3 adults, 3 skulls.	
	Min.	Max.	Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length, to front of c...	27·5	30	27·5	29	27	28·3
„ mastoid width	14·8	16	15·2	15·3	14·8	14·9
„ width of brain-case	12·2	13·2	12·8	13	12	12·6
„ zygomatic width	16·8	18·5	17	17·7	16·8	17·5
„ maxillary width, across m^1	12·2	13·2	12·8	13	12·1	12·7
„ across cingula of canines...	7·8	8·2	8·1	8·4	7·8	8
Mandible, to front of inc.	19·3	20·8	19·5	20	19	19·2
Upper teeth, c–m^2	9·9	10·8	10·1	10·7	10·1	10·2
Lower teeth, c–m_3	10·8	11·8	11·2	11·8	11	11
Ear-conch, length, inner margin .	15·2	16·8	15·7	16·5		
„ length, outer margin .	21	23·6	21·5	22·5		
„ width.....	14·5	16	14	14·5		
Tragus, length	7·2	7·8	6·8			
Lancet, length	8	10·5	9	10·5		
„ width	6·8	7·8	6	6·8		
Horseshoe, width	7·2	9	7·7	7·7		
Forearm	57·8	65·2	58·8	61·2	60	62·2
Pollex.....	13·8	15·6	13	14·5	...	15·8
3rd metacarpal	50·8	59	54	54·8	54·7	55·2
III^1	17	20·2	17	18·8	16·8	18·5
III^2	26·2	32·8	29·5	30	28·5	31·2
III^3	15	18·8	14·7	16·2	15	16
4th metacarpal.....	50	57·8	52·2	54	53	53
IV^1.....	15	17·8	14·7	16·2	15	16·2
IV^2.....	17·5	22	19·2	20	18	19
5th metacarpal.....	51·8	59·7	54·2	55·2	54·3	56
V^1	11·5	14	11·3	12	12	13·5
V^2	13	17·7	14·2	15·2	13·5	16
Interfemoral.....	15	21	12	12·8		
Lower leg	21·8	25	21·7	22·5	21·8	23·2
Foot, with claws	15	17·2	14·7	15·8		
Calcar	6·5	8·2	7·5	7·8	5·5	6·5

stated to be "vier auf jeder Seite"; if this is correct, the bat is *A. j. lituratus*. But three points make me hesitate to draw this conclusion:—first, Prince Maximilian describes the incisors and canines of *Ph. obscurum* tolerably well, but passes very lightly over the molars; if his examination of these latter has been similarly cursory, he may very easily, indeed, have overlooked the rudimentary m^3: second, the length of the head and body is stated to be "3″"; it would seem to be too small for an *A. j. lituratus*, but would agree very well with *A. p. planirostris*: third, he describes in the same book a "*Ph. superciliatum*," also from Rio de Janeiro, which probably is *A. j. lituratus*, and it might seem rather unlikely that he has described, a few pages later, a specimen of the same form as *Ph. obscurum*; this latter argument is, however, rather weak; the possibility is not quite excluded that *Ph. superciliatum* might be the light "phase," *Ph. obscurum* the dark "phase" of one species; but the other evidence speaks against this assumption. Only a re-examination of the type of *Ph. obscurum*, if it still exists, can place the identification beyond doubt.

Artibeus planirostris trinitatis K. And.

1893. *Artibeus planirostris* Spix, Thomas, Journ. Trinidad Field Nat. Club, i. no. 7, p. 6 (April 1893).—Trinidad.
1897. *Artibeus planirostris* Spix, J. A. Allen & Chapman, Bull. Am. Mus. N. H. ix. Art. ii. p. 15 (26 Feb. 1897).—Trinidad.
1906. *Artibeus planirostris trinitatis* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 420 (1 Dec. 1906).—Type locality: Trinidad.

Diagnosis.—Similar to *A. p. planirostris*, but averaging smaller, with slightly smaller skull and teeth.

A. p. trinitatis and *planirostris.*—*A. p. trinitatis* can only be discriminated from its nearest relative, *A. p. planirostris*, by average characters. In *A. p. trinitatis* the forearm and metacarpals average about 4 mm., the tibia 1·5 mm. shorter; the ears are, generally, a little smaller; the average difference in the size of the skull and teeth is very small. For further details see table of measurements, below p. 246.

Specimens examined.—13 specimens (6 skins) and 9 skulls, from the following localities:—

British Museum:—Trinidad (5).—Tobago (2).—5 skulls, representing both localities.

U.S. National Museum *:—Trinidad (6).—4 skulls.

Range.—The islands of Trinidad and Tobago, W.I.

Artibeus planirostris grenadensis K. And.

1906. *Artibeus planirostris grenadensis* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 420 (1 Dec. 1906).—Type locality: Grenada, W.I.

Diagnosis.—In the size of the skull and teeth very similar to

* U.S. N. M. nos. 101898-99 104016, 104018, 104022-23.

A. p. planirostris, in external dimensions rather intermediate between *A. p. trinitatis* and *planirostris*.

A. p. grenadensis *and closely allied forms.*—The skull, teeth, and external dimensions of *A. p. grenadensis* average somewhat larger than in its nearest relative, *A. p. trinitatis*. The size of the skull and teeth is almost quite as, or if anything still a trifle larger than, in *A. p. planirostris*, but externally *A. p. grenadensis* averages somewhat smaller than this latter race. For details see the table of measurements, p. 246.

Though undoubtedly an offshoot of the Trinidad-Tobago race, this form has almost reversed to the size of the continental *A. p. planirostris*; practically it is difficult to discriminate *A. p. grenadensis* from this latter. But even if it were proved that *A. p. grenadensis* is, also in average characters, completely similar to the Venezuelan and Brazilian *A. p. planirostris*, it would be reasonable to keep it separate; there is only one other alternative, viz. to unite *A. p. planirostris*, *trinitatis*, and *grenadensis* into one "race," as opposed to the unquestionably much more different *A. p. fallax*; but this would obliterate the two facts that passing from Venezuela to Trinidad-Tobago there is a decrease in the average size of the individuals, and passing from Tobago to Grenada there is, again, an increase in the average size,—facts which seem to me worth recording and, if so, are to be expressed in the technical names of these bats.

Specimens examined.—11 specimens (6 skins) and 8 skulls, from the following localities:—

British Museum:—Grenada, W.I. (5).—2 skulls.

U.S. National Museum * :—Grenada, W.I. (6).—6 skulls.

Range.—As yet recorded only from the island of Grenada, Windward Isles, W.I.

Artibeus planirostris fallax Pet.

1865. *Artibeus fallax* Peters, MB. Akad. Berlin, pp. 355–57.—Type locality: Guiana.
1878. *Artibeus planirostris* Spix (partim), Dobson, Cat. Chir. Brit. Mus. p. 517.—British Guiana.
1898. ? *Artibeus planirostris* Spix, Thomas, Boll. Mus. Torino, xiii. no. 315, p. 3 (18 April, 1898).—Caiza, Tarija, S. Bolivia.
1901. *Artibeus planirostris* Spix, Thomas, Ann. & Mag. N. H. (7) viii. p. 143 (Aug. 1901).—Kanuku Mts., B. Guiana (specimens examined).
1901. *Artibeus planirostris* Spix, Thomas, Ann. & Mag. N. H. (7) viii. p. 191 (Sept. 1901).—Para (specimen examined).
1902. ? *Artibeus hercules* Rehn, Proc. Acad. N. Sci. Philad. pp. 638–39 (12 Oct. 1902).—E. Peru.
1904. ? *Artibeus planirostris* Spix, J. A. Allen, Bull. Am. Mus. N. H. xx. Art. xxix. (8 Oct. 1904).—Ciudad Bolivar, Venezuela.
1907. *Uroderma validum* D. G. Elliot, Field Col. Mus., Publ. no. 115, Zool. Ser. vol. viii. pp. 537–38, fig. 74 (skull).—Cayenne.

Diagnosis.—Similar to *A. p. planirostris*, but averaging considerably larger.

A. p. fallax *as compared with the other races.*—*A. p. fallax* is the most completely differentiated of the four races of *Artibeus*

* U.S. N. M. nos. 111510, 111513–14, 111517, 111519, 111523.

planirostris described in this paper. The largest skull available is 3 mm. longer, 2·3 mm. broader (zygomatic width) than the largest skull of *A. p. planirostris*; the upper tooth-row, in the largest specimen, is 1·2 mm. longer than in the largest *A. p. planirostris*; there is approximately the same difference between the smallest skull of *A. p. fallax* and the smallest of *A. p. planirostris*, and the average difference in the size of the skull and teeth is, consequently, very well marked. The difference in the external dimensions is equally pronounced, *A. p. fallax* being, as a rule, noticeably larger than *A. p. planirostris*. See the table of measurements, p. 246.

I have had no real difficulty in discriminating any individual of *A. p. fallax*, in the whole large series examined, from *A. p. planirostris*; only one unusually small specimen of the former race from Demerara (B.M. no. 75.11.3.17) caused me some hesitation. Nevertheless, *A. p. fallax* cannot, in my opinion, be separated as a distinct species, but only as a local race of *Artibeus planirostris*, for the following reasons:—First, there is no structural difference, in any respect, between *A. p. fallax* and the other races; second, small individuals of *A. p. fallax* come so exceedingly near to large individuals of *A. p. planirostris* that there can be no doubt that, occasionally, the two forms will prove to be practically quite indistinguishable; third, some examples of *A. p. fallax* from the Lower Orinoco Valley (Ciudad Bolivar) and Para show decidedly leanings towards *A. p. planirostris*, and there at least, in the border districts between the areas occupied by the two races, they will, no doubt, be found to intergrade.

Specimens examined.—55 specimens (42 skins) and 36 skulls, from the following localities:—

British Museum:—Para (2).—French Guiana: Cayenne (8).—British Guiana: Demerara (6); Comachka, Demerara River (5); Essequibo River (20); Kanuku Mts., about 59° W., 3° N. (11); B. Guiana (1).—Lower Orinoco: La Vuelta, Ciudad Bolivar (2).—36 skulls, from all the localities enumerated.

Range.—Guiana, extending southward to Para, where it meets *A. p. planirostris*, northward to the Lower Orinoco Valley, where it also meets *A. p. planirostris*.

If Rehn's *Artibeus hercules*, from E. Peru, and a specimen of *A. planirostris* recorded by Oldfield Thomas (*l. s. c.*) from Caiza, S. Bolivia, neither of which has been examined by me, are referable to *A. p. fallax*, the range of this form is considerably more extensive.

Peters's *A. fallax*, 1865.—The species was based on "einem weiblichen Exemplar in Weingeist" from Guiana in the Berlin Museum, and "anderen trockenen Exemplaren" in the Leyden Museum (probably specimens *b* and *c* in Jentink's 'Cat. Syst. Mamm.' p. 208, 1888). According to Peters (*l. s. c.*) *A. fallax* is in size, in the form of the ears and nose-leaves, and in colour "dem *A. perspicillatus* [*A. jamaicensis* of the present paper]

täuschend ähnlich und gewiss auch schon oft mit ihm verwechselt worden," but differs in the following respects: "Der untere Rand des Hufeisens ist länger, deutlicher abgesetzt und fein gekerbt. Das Gebiss ist namentlich dadurch verschieden, dass der zweite obere wahre Backzahn am hinteren Rande hinter dem Zacken des Cingulums [cusp 5 of this paper] viel tiefer eingebuchtet ist, und dass hier ein sehr kleiner fünfter Backzahn sich hineinlegt." —This statement, taken together with the locality, leaves no doubt as to the identification of *A. fallax*.

Rehn's *A. hercules*, 1902.—Type locality: Eastern Peru; two specimens (one skull). Its "general characters" were summed up by Rehn (*l. s. c.*) as follows:—"Allied to *A. planirostris* (Spix), but differing in the larger size, the much larger foot, and in numerous dental characters." These latter are thus described:—"Second upper premolar subquadrate in basal outline, quite different from the subpyriform tooth of *A. planirostris*, the internal node well developed and forming a conspicuous cusp. First upper molar broad, deep, the anterior inner angle more developed than in *A. planirostris*, which species has this portion rounded. Second lower premolar very heavy and broad, the posterior internal border with the dentate ridge low. First lower molar subquadrate in outline." Upper tooth-row 12, lower tooth-row 12·5, maxillary width across m^1 14·5 mm.; forearm 65·2, 3rd metacarpal 61·5, tibia 24 mm.

Rehn had for comparison two *A. planirostris* from "Chapada [Matto Grosso], Brazil"; so it was quite natural that he found the large, large-skulled and large-toothed Peruvian bat considerably different in size. But if he had been able to compare it with *A. p. fallax*, he would have seen that the size of the two Peruvian examples is in every respect precisely as in the Guianan form described long ago by Peters. If, further, he had had a tolerably good series of skulls of *A. p. fallax* and *A. p. planirostris*, he would have realised that the dental characters as derived from the single skull of *A. hercules* examined by him have neither specific nor subspecific importance, but are individual peculiarities, found in any form of *A. planirostris* (as, indeed, they are found also in the various forms of *A. jamaicensis*). As to this latter point I subjoin the following details:—p^4, in a series of six skulls of *A. p. fallax* (B.M. nos. 3.4.5.22–27), all of adult individuals, none with the teeth much worn, all from Cayenne and taken almost on the same date: basal outline subpyriform in two skulls; subquadrate with strongly rounded inner margin, in one; subquadrate with slightly rounded inner margin, in one; subquadrate with straight inner margin, in one; strongly subquadrate (nearly quadrate) with straight inner margin, in one. The antero-internal cusp on the heel ("internal node," Rehn) of p^4 varies, in this series, from small, through strong, to very strong; the cusp is not always most conspicuous in quite unworn teeth. m^1, in the same series from Cayenne:—one extreme (two skulls): short antero-posteriorly, broad from side to side, antero-internal angle quite

rounded (this would be, so far as this character is concerned, Rehn's *A. planirostris*); the other extreme in the same series of skulls (one specimen): m^1 long antero-posteriorly, especially in its lingual half, antero-internal angle very sharp, practically rectangular (this would be Rehn's *A. hercules*); in the three remaining skulls the tooth is intermediate in shape. As to p_4 and m_1, I must confess I do not quite understand Rehn's description, unless "second lower premolar" is a lapsus for first lower molar, and "first lower molar" for second lower molar; there is, of course, no "dentate ridge" on the postero-internal border of p_4 in any bat of the genus *Artibeus*, but there is on m_1, and the absolute size of the cusps of this dentate ridge (cusps 2 and 3) is subject to notable individual variation.—When entering upon such minute details as here under consideration, we shall scarcely find two skulls of *A. p. fallax* (or any other form of *A. planirostris*) precisely alike; we have passed from the characters useful for a specific or subspecific discrimination to the field of individual variation, and, judging from what I have seen in a large series of skulls of *A. p. fallax*, I should think it highly probable that if Rehn extracted the skull of his second specimen of *A. hercules*, he would find the form of the lingual portion of p^4 or m^1 or both of them slightly differing from that of the corresponding teeth in the single skull described.

It is, of course, quite possible that Peruvian individuals differ in some minor details (or some average characters) from the Guianan *A. p. fallax*; for the present it is at least certain that there is not in Rehn's description one single character by which *A. hercules* can be discriminated from *A. p. fallax*.

Elliot's *Uroderma validum*, 1907.—Type locality: Cayenne. From the figures of the skull, the description and measurements, clearly an *A. p. fallax*. Elliot has apparently been unaware of the fact that the type of *U. validum* (Cayenne) is practically a topotype of *A. p. fallax* Peters (Guiana).

Artibeus hirsutus K. And.

1906. *Artibeus hirsutus* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 420 (1 Dec. 1906).—Type locality: Michoacan, Mexico.

Diagnosis.—Like a small form of *A. planirostris* (though averaging still smaller), but tibia and interfemoral densely haired, and colour of fur of upper side of body in adults drab with a silvery tinge. Maxillary tooth-row 9·5–10·4 mm.; forearm 53·7–59·7 mm.

Skull and teeth.—In the skull and teeth there is no essential difference between *A. hirsutus* and a small form of *A. planirostris*, f. i. *A. p. trinitatis*; the rostrum of the skull may, perhaps, average somewhat narrower.—Molars $\frac{2}{2}$, as in *A. concolor* and *planirostris*, and as in these species the presence of the small m^3 is almost constant. Eight skulls of *A. hirsutus* have been examined; in two (♀ ad., teeth unworn, Michoacan, U.S. N. M.

Measurements of Artibeus concolor, planirostris, *and* hirsutus.

	A. concolor.	*A. planirostris.*											*A. hirsutus.*		
	♀ ad.	*planirostris.* 22 adults, 17 skulls.			*trinitatis.* 13 adults, 9 skulls.			*grenadensis.* 9 adults, 8 skulls.			*fallax.* 41 adults, 33 skulls.			8 adults, 8 skulls.		
		Min.	Max.	Med.	Min.	Max.	Med.	Min.	Max.	Med.	Min.	Max.	Med.	Min.	Max.	Med.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to front of c	22·4	27	30	28·5	27·3	28	27·8	28·2	29·7	28·9	29·5	33	30·7	26·8	28·7	27·6
„ mastoid width	11·8	14·8	16	15·4	14·8	15·2	15·1	14·8	16·3	15·5	16	18	16·7	14	15·2	14·7
„ width of brain-case	10·3	12	13·2	12·9	12·5	12·8	12·7	12·7	13·8	13·1	13	14·6	13·8	11·8	12·7	12·5
„ zygomatic width	14	16·8	18·5	17·6	16·2	17·5	16·8	17·3	19·2	18	18·3	20·8	19·3	16·2	18	17·2
„ maxillary width across m^1	9·4	12·1	13·2	12·9	12·2	12·8	12·5	12·7	13·8	13·1	13	15	14	11·3	13	12
„ across cingula of canines	6·4	7·8	8·4	8·2	7·7	8·3	8	8·2	8·8	8·5	8·6	9·8	9·1	7	8·2	7·6
Mandible, to front of inc.	14·8	19	20·8	20·1	18·8	20	19·4	20	21	20·5	20·8	23	21·6	18	19·3	18·7
Upper teeth, c–m^2	7·2	9·9	10·8	10·3	9·8	10·3	10	10·3	11	10·8	10·4	12	11·2	9·5	10·4	10
Lower teeth, c–m_3	8	10·8	11·8	11·3	10·6	11·3	10·9	11·2	12	11·6	11·7	13	12·3	10	11·1	10·8
Ear-conch, length, inner margin	13	15·2	16·8	16·1	14·2	15·5	14·6	13·8	14·8		16	17·5	16·6	14·5	15	
„ length, outer margin	17·7	21	23·6	22·2	20·5	21·8	21	20·5	21·5		21	24	22·5	19·5	20·5	
„ width	14	14	16	14·9	13·8	15	14·6	13·8	14·5		14·5	16·5	15·2	13	14	
Tragus, length	6	6·8	7·8	7·4	7	7·5	7·1	7	7·5		7·2	8·5	7·7	6·5	7·2	
Lancet, length	9·8	8	10·5	9·6	9	10·5	9·8	9	10		9·8	11·5	10·6	8	9	
„ width	6	6	7·8	7	6·2	7·2	6·9	6·2	7		7	9	8	5·5	7·5	
Horseshoe, width	6·8	7·2	9	8·1	7	8	7·7	7·5	8		8·3	9·8	8·8	7	8·3	
Forearm	50	57·8	65·2	61·8	55	60	57·7	57·5	61·3	59·4	62·8	73	66·5	53·7	59·7	55·9
Pollex	13·8	13	15·8	14·5	13·5	14·8	14·1	14	15·5	14·5	14·2	17·2	15·7	12·8	14	13·5
3rd metacarpal	46·7	50·8	59	55·6	48	55·2	51·7	52·5	56	54·3	53·5	66·7	59·8	48·2	51	49·6
III^1	16	16·8	20·2	18·5	16	19·2	17·5	17	19	17·9	17·8	22	19·7	14·8	16·8	15·7
III^2	24	26·2	32·8	30·1	26	29·5	28·2	27·2	31	29·2	27·5	35·3	32	25·2	28·8	26·9
III^3	13·2	14·7	18·8	16·4	14·7	17	15·5	14·2	17	15·6	15·8	19·8	17·6	13·3	16·5	14·6
4th metacarpal	45	50	57·8	54·7	46	53·5	50·1	50·8	55	53	52·8	64·2	58·7	47·2	50	48·5
IV^1	13·2	14·7	17·8	16·2	14·5	16·8	15·4	14·7	16·7	15·7	15	19	17·3	12·8	14·8	13·7
IV^2	16·2	17·5	22	19·9	18	20	19·1	17·7	20·7	19	20	26	22·1	16·7	18·5	17·5
5th metacarpal	45·2	51·8	59·7	56	49·3	54·8	51·6	52·5	56·5	54·3	54·2	66	60·2	48·2	52	49·8
V^1	11·5	11·5	14	12·3	11	12·7	11·5	10·8	12·7	11·7	11·8	15	13·2	9·2	11·5	10·4
V^2	13·2	13	17·7	15·5	13·5	15·2	14·4	13·5	16	14·5	14·7	17·8	16·3	11·7	14	12·9
Interfemoral	12·7	12	21	16·8	12	18	14·5	16	19		16	20·5	19·1	13	15·5	
Lower leg	18·6	21·7	25	23	20·2	22·2	21·4	21·2	23·5	22·5	22	26	24·7	19·8	22	20·7
Foot, with claws	11·8	14·7	17·2	16·1	14·7	16·5	15·5	15	16·5	15·8	15	18·8	17·3	14	15	14·7
Calcar	6·8	5·5	8·2	7·5	5·5	7·8	7·1	6·7	7·8	7·3	6·5	8·2	7·5	5	6·8	5·9

no. 126451; and ♂ ad., teeth slightly worn, Colima, U.S. N. M. no. 52091) m^3 and its alveolus are wanting on one side, in none on both sides.

Nose-leaves.—Of eight specimens examined, four are preserved in alcohol; in one of these latter the front margin of the horse-shoe is free, but narrow; in three it is almost continuous with the integument of the muzzle. Thus there is in this species the same variation in this respect as in *A. planirostris* (p. 235) and *A. jamaicensis* (p. 253).

Tragus.—About three small, rounded, sometimes almost obsolete serrations above the median projection.

Wings.—The metacarpals and phalanges (especially the proximal phalanges) are proportionately a little shorter than in *A. planirostris*. The wing-indices on p. 310 and the table of measurements, p. 246, show the details.

Hairing on limbs and interfemoral.—Different from *A. planirostris*. The whole of the interfemoral (above and below) right to the posterior margin, and the upper side of the femur, tibia, and foot are densely haired.

Colour.—General impression: much more drab above and lighter beneath than in any phase of *A. planirostris*.

Upper side dark drab or brownish drab, with very short, almost greyish-drab tips to the hairs, giving the whole of the upper side a peculiarly silvery tinge; base of hairs of hinder back grey with a tinge of ecru-drab, in the shoulder region and on the neck noticeably lighter, whitish ecru-drab. Under side smoke-grey with conspicuous white tips to the hairs. Supraorbital stripes indistinct or none.

Specimens examined.—8 specimens (4 skins), with skulls, from the following localities:—Michoacan: La Salada (3); Colima: Colima (3); Jalisco: Etzatlan (1); W. Mexico (1).—All from the collection of the U.S. National Museum*.

Range.—As yet only known from the States of Michoacan, Colima, and Jalisco, Mexico.

Artibeus jamaicensis Leach.

Diagnosis.—Molars $\frac{2}{3}$. Maxillary tooth-row 9·3–12·2 mm. Forearm 54–76 mm.

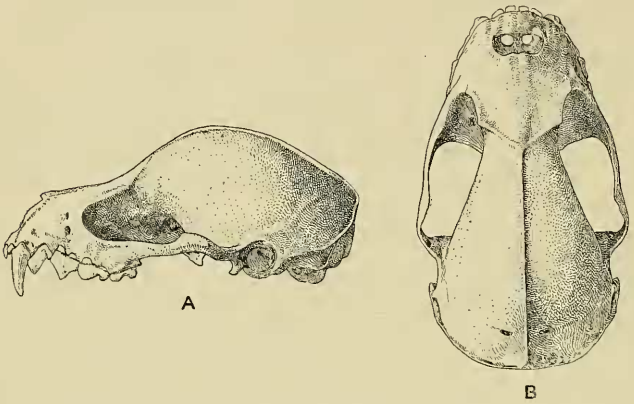
Skull.—Similar in shape to that of *A. planirostris*. In the largest race of *A. jamaicensis* (viz. *A. j. lituratus*) the size of the skull is practically as in the largest form of *A. planirostris* (*A. p. fallax*), though averaging still a trifle more heavily built; so complete is the resemblance that certain skulls of *A. j. lituratus* would be indistinguishable from those of *A. planirostris*, were it not for the absence of the small m^3. In the smallest races of *A. jamaicensis* (*A. j. parvipes* and *yucatanicus*) the skull is as small and delicately built as (or, if anything, still smaller than) in *A. planirostris trinitatis* or *A. hirsutus*.

The skull, especially its facial portion, is in certain races of

* U.S. N. M. nos. 9052 (36860), 52063, 52091, 52092, 52101, 126448–49 126451.

A. jamaicensis subject to considerable modification dependent on the age of the individuals; one of these modifications has served as type for the description of a distinct species (J. A. Allen's *A. intermedius*). The text-figures below show, approximately, the two

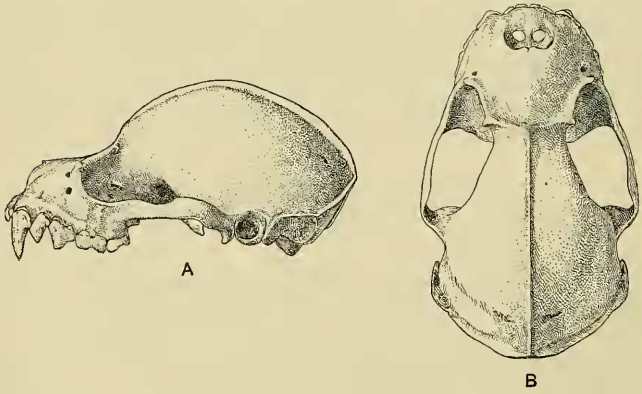
Text-fig. 50.



Artibeus jamaicensis palmarum, ♀ ad. Macuto, Venezuela, July 14, 1900. U.S. N. M. 102845.

A. Lateral, B. Upper view of skull. × $\frac{3}{2}$.

Text-fig. 51.



Artibeus jamaicensis palmarum, ♂ ad. Macuto, Venezuela, July 14, 1900. U.S. N. M. 102843.

A. Lateral, B. Upper view of skull. × $\frac{3}{2}$.

extremes in the shape of the skull in adult individuals (in some skulls examined the old age modification is carried still a little

farther than represented in fig. 51):—the two skulls of *A. j. palmarum* figured are from the same place (Macuto, La Guaira, Venezuela); the one (fig. 50) is of an adult female with the distal epiphyses of the metacarpals ossified, but the teeth unworn, *i. e.* a mature but young individual; the other (fig. 51) an older male with somewhat worn teeth: these two skulls have been selected as paradigmata, because they belong to the same geographical race of *A. jamaicensis* and were obtained precisely at the same locality; but perfectly similar extremes are found in other skulls of the series examined, and not only in *A. j. palmarum* but in *A. j. lituratus* as well (f. i. in a British Museum series of this latter race, from Sapucay, Paraguay). The skulls figured are, the one of a female, the other of a male, but the modifications have nothing to do with sexual differences. In the rather younger individual (fig. 50) the brain-case makes the impression of being lower, the naso-frontal depression (on the dorsal face of the rostrum, in front of the sagittal crest) is shallow; the supraorbital ridges, where starting from the anterior point of the sagittal crest, form an angle with this latter of about 125°–135°, the postorbital processes are very inconspicuous (in still younger individuals scarcely indicated). In the somewhat older individual (fig. 51) the brain-case makes the impression of being higher, more vaulted, but the difference is more apparent than real, chiefly due to the higher and more forwardly extending sagittal crest. This latter fact, that the sagittal crest has been produced farther forward, has two other effects—first, that the naso-frontal depression (viewed in profile) is more abrupt; second, that the supraorbital ridges are not directed forward and outward, but almost straightly outward, forming an angle with the sagittal crest of very little more than 90°; the postorbital processes are very conspicuous, and a pair of comparatively large anteorbital processes has been developed.

The adult and old age modification of the skull as described above is characteristic of the forms called in this paper the "southern races" of *A. jamaicensis* (viz. *A. j. lituratus*, *palmarum*, *præceps*). The transition from the young to the old stage takes place earlier in some individuals than in others; I have seen individuals with somewhat worn teeth which have still almost the young type of skull, or are only in a transitional stage, while others with almost quite unworn teeth have already reached far on the way towards the old age type.—The "northern" races (*A. j. parvipes*, *yucatanicus*, *jamaicensis*, *æquatorialis*) never, or exceedingly rarely, reach that degree of old age modification of the skull attained by the southern races.

A. j. parvipes, *yucatanicus*, *jamaicensis*, and *æquatorialis* retain, throughout the whole life, a shape of the facial portion of the skull not very different from that of immature individuals of all races; in *A. j. lituratus*, *palmarum*, and *dominicanus* the skull of aged individuals is very conspicuously modified. From this it is concluded that the former group of races, in this particular

respect, is slightly more primitive than the latter group. Other facts, to be mentioned hereafter, point to the same effect.

Teeth.—As in *A. planirostris*, with the following differences:—

m^3, which is rudimentary in *A. planirostris*, has definitely disappeared in *A. jamaicensis*. 185 skulls, of the seven subspecies recognised in this paper, and of practically all ages, from half-grown to very old individuals, have been examined; all of them lack m^3, and in none is there any trace of the tooth having been present.

m_3 is on the whole still somewhat smaller than in *A. planirostris*. When, as is the case in *A. jamaicensis*, the development has reached the point that m^3 is invariably wanting and m_3 reduced to a mere rudiment, it might be anticipated that this rudimentary m_3 would, probably, show some tendency towards complete disappearance. But it must be said at once that individuals lacking m_3 on both sides of the jaw, without any trace of its alveoli, are extremely rare; the remarkable fact is not that such exceptions do occur, but, in view of the minute size of the tooth, that they do not occur more often. In two individuals (a young adult *A. j. jamaicensis* from San Domingo, B. M. no. 50.7.8.43; and a fully adult male, with unworn teeth, of the same race from Peten, Guatemala, U.S. N. M. no. 37912) m_3 is entirely wanting on one side; in four individuals (an adult male, with somewhat worn teeth, of *A. j. palmarum* from Costa Rica, B.M. no. 98.10.9.4; a young female of *A. j. jamaicensis* from Oaxaca, Mexico, U.S. N. M. no. 73255; an aged male, with much worn teeth, of *A. j. jamaicensis* from Morelos, Mexico, U.S. N. M. no. 64482; and an adult male, with unworn teeth, of the same race from Old Providence Island, U.S. N. M. no. 37811) it is wanting on both sides. Thus in 97 p. ct. of the 185 skulls examined m_3 (or its alveolus) is present on both sides, but averaging a little smaller than in *A. planirostris*, in 3 p. ct. it is completely wanting either on one side or on both sides.

In those few species of *Artibeus* which have preserved a rudimentary m^2, this tooth is situated postero-internally to m^2, partly fitting into a sharp, subrectangular emargination in the posterior border of this latter tooth, between its cusps 5 and 7 (text-fig. 41 A, on p. 208). What becomes of this angular notch, when, as is invariably the case in *A. jamaicensis*, m^3 completely disappears? It is an interesting fact that in the races of northern origin (*A. j. parvipes*, *yucatanicus*, *jamaicensis*, *æquatorialis*) the emargination is, in 77 p. ct. of the individuals, preserved quite or almost as conspicuous as in any *A. planirostris*, sometimes (in about 19 p. ct.) it is decidedly reduced in size, rarely (4 p. ct.) almost or quite disappeared; whereas in the races of southern origin (*A. j. lituratus*, *palmarum*, *dominicanus*) the emargination has only been preserved, as conspicuous as in *A. planirostris*, in about 10 p. ct.; in 38 p. ct. it is decidedly on the way towards disappearance, in 52 p. ct. it has practically disappeared. Thus, the northern races, though having like their southern relatives

lost m^3, have in the large majority of individuals preserved the notch in m^2 into which m^3 fitted; they have, consequently, also in this respect remained in a slightly more primitive stage than the southern races, in which the notch, in no less than 90 p. ct. of the individuals, is either conspicuously reduced or quite obliterated.

The disappearance of the sharp angular notch between cusps 5 and 7 of m^2 is *not* effected by a reduction of the large, posteriorly projecting cusp 5 (which would imply a decrease in the area of m^2), but, on the contrary, by a filling out of the notch, consequently by a slight increase in the volume of m^2; it is as if the loss of m^3 has been compensated by a corresponding, or partly corresponding, addition to that part of m^2 against which the missing m^3 was pressed: in other words, the function of the missing m^3 has, in the more highly developed races of *A. jamaicensis*, been transferred, to a certain extent, to the postero-internal border of m^2 (text-fig. 52).

Text-fig. 52.

A. *Artibeus jamaicensis jamaicensis*, ♀ ad. St. Andrew's I. B.M. 92.12.20.6. Right m^2, to show strong emargination of hinder margin of tooth. × $\frac{4}{1}$.

B. *Artibeus jamaicensis lituratus*, ♂ ad. Morretes, Parana. B.M. 3.7.1.127. Right m^2, to show slight emargination of hinder margin of tooth. × $\frac{4}{1}$.

Reference has been made above to the fact that of 185 skulls only 6 lack m_3 either on one side or on both sides of the mandible, and it may be worth the while drawing attention also to the fact that of these 6 aberrant individuals no less than 5 belong to the race *A. j. jamaicensis*. The number of skulls examined of this race is 75, the number of aberrant individuals 5 (about 7 p. ct.); the number of skulls of all other races together is 110, of which only one single individual is aberrant (1 p. ct.). It is probably not quite accidental that in the large series examined *the loss of m_3 is less rare in the northern group of races*. m_3, in *A. planirostris*, works against the whole surface of the small m^3 and a very narrow postero-internal margin of m^2. When now, as is the case in the large majority (about 80 p. ct.) of individuals of the *northern* races of *A. jamaicensis*, there is no compensation at all for the loss of m^3 (*i. e.*, no filling up of the notch in m^2 into which m^3 fitted), then m_3 has exceedingly little or nothing at all to work against in the upper jaw, and it appears quite conceivable that in such circumstances it shows a rather more pronounced tendency to disappearance. In the *southern* races, on the other

hand, the loss of m^3 is, in the large majority of individuals (about 90 p. ct.), more or less compensated by a slight increase in the postero-internal portion of m^2 (by a filling up, partly or completely, of the notch between cusps 5 and 7), and, consequently, m_3 has almost as much to work against in the upper jaw as in those species which possess an m^3; the disappearance of m_3 is, probably for this reason, of extreme rarity in the southern races.

So far as m^3 and the notch in the posterior margin of m^2 are concerned, the various stages represented by *A. planirostris* and *jamaicensis* may be tabulated as follows:—

(A) m^3 present on both sides: almost all *A. planirostris* (94 p. ct.).
(B) m^3 present on one side, entirely wanting on the other: 3 p. ct. of *A. planirostris*.
(C) m^3 entirely wanting on both sides: 3 p. ct. of *A. planirostris*; all *A. jamaicensis*.
  (1) Notch in hinder margin of m^2, between cusps 5 and 7, perfectly preserved (*i. e.* as distinct as in any *Artibeus* which possesses an m^3): the large majority (77 p. ct.) of the individuals of the northern races of *A. jamaicensis* (*A. j. parvipes, yucatanicus, jamaicensis, æquatorialis*); a small minority (11 p. ct.) in the southern races (*A. j. lituratus, palmarum præceps*).
  (2) Notch in hinder margin of m^2 decidedly reduced: a minority (19 p. ct.) in the northern races; a large number (38 p. ct.) in the southern races of *A. jamaicensis*.
  (3) Notch in hinder margin of m^2 almost or completely filled up: a vanishing minority (4 p. ct.) in the northern; half the number of individuals (51 p. ct.) in the southern races of *A. jamaicensis*.

The subjoined table and diagram are intended to give a view of the gradual reduction of the notch between cusps 5 and 7 of m^2 in the various races of *A. jamaicensis* (one race, *A. j. præceps*, as being too poorly represented in the collections examined, is excluded from the table; it apparently agrees with its nearest relatives, *A. j. palmarum* and *lituratus*):—

	Total number of skulls examined.	Angular emargination between cusps 5 and 7 of m^2		
		quite or almost as conspicuous as in any *A. planirostris*.	decidedly reduced.	almost or quite disappeared.
parvipes	12	92 p. ct.	8 p. ct.	0 p. ct.
yucatanicus	10	80 „	20 „	0 „
jamaicensis	74	75 „	22 „	3 „
æquatorialis.....	8	75 „	12·5 „	12·5 „
lituratus	42	12 „	36 „	52 „
palmarum.....	30	10 „	40 „	50 „
Northern races...	104	77 p. ct.	19 p. ct.	4 p. ct.
Southern races ...	72	11 „	38 „	51 „

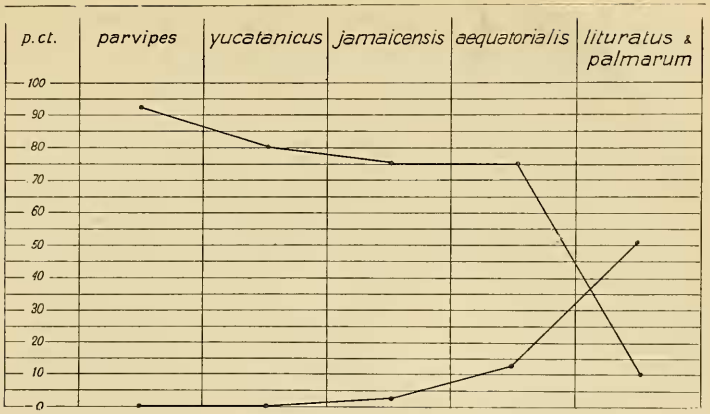


Diagram showing the percentage of individuals, in the races of *Artibeus jamaicensis*, in which the angular emargination between cusps 5 and 7 of m^2 (former place of m^3) (1) is quite, or almost, as pronounced as in any *A. planirostris* (upper curve), (2) has almost, or quite, disappeared (lower curve).

Tragus.—In most individuals there are 4 or 5 quite small serrations on the outer margin of the tragus, above the median projection; the serrations may be sharp, but as a rule they are more or less rounded off, rather often reduced to inconspicuous nodules; very often the number is reduced to 3 (generally by obliteration of the lower ones), rarely to 2, and still more rarely all serrations are almost obliterated, the margin from the median projection to the tip of the tragus being practically simple. There is every transition between these stages, and they occur in all races.

Nose-leaves.—According to Dobson *A. jamaicensis* (*A. perspicillatus* in his 'Catalogue') is "at once distinguished" from *A. planirostris* by having the front margin of the horseshoe "completely bound down to the muzzle, in some individuals even confluent with its integument," whereas in *A. planirostris* the margin is "free, separated from the muzzle, straight, unnotched." This character is thoroughly untrustworthy. First, in the same geographical race of *A. jamaicensis*, often in individuals obtained on the same spot, all transitions can be found, from a horseshoe with the front margin as free as in any *planirostris*, to a horseshoe with the front margin completely continuous with the integument of the muzzle, as shown in the table, p. 254 (based exclusively on specimens preserved in alcohol). Second, in *A. planirostris* the front margin is, as a rule, more or less free, but individuals occur in which it is so completely bound down as to be almost confluent with the integument of the muzzle.—The front margin of the horseshoe is often simple, sometimes more or less crenulate; the crenulations extend not rarely over the whole of the lateral margins, sometimes even over a smaller or greater

part of the lancet. The lateral margins of the horseshoe are sometimes turned up so as to form a fold; in some individuals they even show some indications of an emargination.

	Front margin of horseshoe		
	quite, or almost, as free as in any *A. planirostris*.	rather more definitely fastened down, but still distinctly projecting.	almost completely, or quite completely, fastened down to, or confluent with, muzzle.
parvipes	Cuba (2).	Cuba (10).	Cuba (4).
yucatanicus	.....	Yucatan (3).	Yucatan (1).
jamaicensis	Honduras (1). Old Providence I. (2). Jamaica (1). Porto Rico (6).	Nicaragua (1). Honduras (1). Guatemala (1). Campeche (3). Chiapas (1). Vera Cruz (1). Old Providence I. (2). Jamaica (5). Porto Rico (5). St. Kitts (1).	Nicaragua (1). Chiapas (2). Oaxaca (2). Vera Cruz (1). Morelos (3). San Domingo (1). Porto Rico (1).
æquatorialis.....	.....	Ecuador (1).	
lituratus	Paraguay (1).	Paraguay (1). Parana (1). Para (1).	Paraguay (5). Sta. Catharina (1).
palmarum.....	Venezuela (2). St. Vincent I. (1).	Venezuela (2). Costa Rica (1). Nicaragua (1). Guatemala (1).	Trinidad (2). Costa Rica (3). Guatemala (3). Jalisco (1).
præceps.....	.....	Guadeloupe (2).	Dominica (1).
All races (94) ...	18 p. ct.	48 p. ct.	34 p. ct.

Wing-indices.—The proportionate length of the metacarpals and phalanges is quite as in *A. planirostris*; so complete is the similarity that the wing-indices of the latter species could be substituted for those of *A. jamaicensis* without any appreciable error (see the table on p. 310).

Hairing on limbs and membranes.—Upper side of proximal two thirds (or half) of forearm, upper side of lateral membranes next to body, of metacarpal of pollex, of femur, tibia, foot, and interfemoral (a narrower or broader distal portion excepted), under side of proximal half of forearm and of proximal portion of interfemoral, very distinctly haired.

In the northern races the upper side of the tibia and interfemoral are generally more sparsely haired than in the southern races, sometimes almost naked.

Colour.—There is often a certain colour difference between

younger and aged individuals; further, some variation in the development of the supraorbital and infraorbital stripes, partly quite individual, partly dependent on age, and partly on the race to which the individuals belong; and last, there is a certain colour difference between *A. j. parvipes*, *yucatanicus*, *jamaicensis*, and *æquatorialis* (*i. e.* the northern races) on one side, *A. j. lituratus* and *palmarum* (the southern races) on the other side. It has therefore proved convenient to give the description of the coloration under the following five headings :—dark-coloured individuals; lighter-coloured individuals; indication of dorsal stripe and white ear-edgings; facial stripes; concluding remarks on the colour.

Dark-coloured individuals.—Upper side, from the shoulder region backward, dark smoky brown, almost blackish brown, this colour confined to the distal third or fourth of the hairs; base of hairs slate. On the anterior part of the upper side, from the shoulder region forward, the hair-bases are as a rule distinctly lighter, almost smoke-grey. Under side dark smoke-grey or brownish smoke-grey, with a peculiarly grizzled appearance, owing to the short whitish or greyish-white tips to the hairs. Tips of wings (region of third, or second and third phalanges of third digit) generally light-coloured (whitish or yellowish white).

This is the extreme of the dark colour-type in fully adult individuals (young, not full-grown individuals are still a shade darker or duller). It occurs in *all* races, but is especially common, and much more frequently retained (or retained in a slightly lighter shade) throughout the whole life, in the northern than in the southern races; about 75 p. ct. of the fully adult specimens examined of the northern races are "dark," as against only 25 p. ct. in the southern races. By advancing age (the precise period varying considerably) the colour becomes gradually of a somewhat lighter shade, even in those individuals which never assume the proper "light phase" described below.

Lighter-coloured individuals.—Upper side, from shoulder region backward, Prout's brown, base of hairs almost wood-brown. On the shoulder region and neck the Prout's brown hair-tips are generally very short or altogether wanting, the wood-brown ground-colour of the fur therefore more or less, or completely, exposed, producing an often very strong contrast between the anterior and posterior parts of the dorsal surface. Under side dull brown, base of hairs very little, or not at all, lighter; extreme tips of hairs generally whitish or greyish white. Tips of wings as in dark-coloured individuals.

This is very nearly the extreme of the light colour. The hair-bases on the shoulder region and neck are in some specimens still lighter than "wood-brown," almost yellowish white.

The dark extreme described above and the light extreme here under consideration are very different indeed, but there is absolutely no sharp line of separation between them; they are connected by many intermediate stages. Putting aside all

variations of shade, the principal stages are these three: dark smoky brown (dark type), Vandyck-brown (intermediate stage), Prout's brown (light type).

The light colour type occurs in *all* races, but much more frequently in the southern than in the northern races; about 75 p. ct. of the fully adult specimens examined of the southern races (representing many different stages of wear of the teeth) are light-coloured, as against only 25 p. ct. of the northern races.

The subjoined table (p. 257) gives a statistical view of the number of dark and light coloured individuals in the large series examined. It is based exclusively on fully adult individuals (distal epiphyses of metacarpals ossified), and exclusively on dried skins, no spirit-specimens, however well preserved, having been taken into account. It will be noticed that 62 p. ct. of the available individuals of the southern races have the teeth from slightly worn to much worn, whereas the same is the case with a somewhat smaller percentage (50 p. ct.) of the northern races; it may, perhaps, have slightly exaggerated the final results, but a glance at the table will be sufficient to prove that it cannot have had any essential influence on the conclusions, which may be epitomised as follows :—(1) Light-coloured individuals are much more common in the southern than in the northern races: (2) of 30 individuals of the northern races which, though fully adult, have the teeth unworn or practically unworn, 28 are dark-coloured; of 20 individuals of the southern races, of corresponding age, only half the number are dark-coloured: (3) of 20 specimens of the northern races with the teeth slightly or somewhat worn, 12 are dark-coloured; of 18 specimens of the southern races of corresponding age, none are dark-coloured: (4) of 9 specimens of the northern races with the teeth well worn or much worn, 4 are dark-coloured; of 15 specimens of the southern races of corresponding age, 2 only are dark-coloured. These two conclusions therefore, would seem to be well founded: that there is a well-marked average difference of colour between northern and southern races; and that the light colour type, though sometimes (particularly in the southern races) occurring in adult individuals with unworn teeth, is especially characteristic of the somewhat more advanced age.

Immature individuals are always dark-coloured; of the northern races the large majority of adult and aged individuals are dark-coloured, of the southern races a minority only. From this it is concluded that the northern races have also in this respect remained in a slightly more primitive stage than the southern forms. One of the following paragraphs will show that a closer study of the development of the head-stripes in these two groups of races leads to the same conclusion.

Indication of dorsal stripe and white ear-edgings.—One specimen of *A. j. jamaicensis* (♀ ad., San Vicente, Chiapas, Mexico, teeth much worn, fur rather light-coloured, U.S. N. M. no. 133044) has a short longitudinal stripe on the hinder part of the back.

Dark and light coloured individuals.

	Total number of skins of adults.	Teeth			All ages of fully adult individuals.
		unworn or practically unworn.	slightly or somewhat worn.	well worn or much worn	
parvipes	9	darker 3, lighter 0.	darker 3, lighter 1.	darker 2, lighter 0.	darker 8, lighter 1.
yucatanicus	9	darker 5, lighter 0.	darker 1, lighter 3.	... ...	darker 6, lighter 3.
jamaicensis	36	darker 19, lighter 2.	darker 7, lighter 3.	darker 1, lighter 4.	darker 27, lighter 9.
æquatorialis	5	darker 1, lighter 0.	darker 1, lighter 1.	darker 1, lighter 1.	darker 3, lighter 2.
lituratus	30	darker 9, lighter 6.	darker 0, lighter 10.	darker 1, lighter 4.	darker 10, lighter 20.
palmarum	23	darker 1, lighter 4.	darker 0, lighter 10.	darker 1, lighter 9.	darker 2, lighter 21.
Northern races	59	darker 28, lighter 2.	darker 12, lighter 8.	darker 4, lighter 5.	darker 75 p. ct. lighter 25 p. ct.
Southern races	53	darker 10, lighter 10.	darker 0, lighter 18.	darker 2, lighter 13.	darker 23 p. ct. lighter 77 p. ct.

The anomaly is worth noticing, because it recalls the white dorsal stripe characteristic of many species of the more primitive genus *Vampyrops* (and of *Uroderma*).

A few individuals show some slight trace of a narrow white margin to the ears, a feature of common occurrence in those species of *Artibeus* which possess $\frac{2}{2}$ molars.

Facial stripes.—Many individuals have two pairs of whitish or yellowish-white, longitudinal stripes on the head, viz. a pair of supraorbital stripes from the base of the lancet, passing above the eye, to a point above the inner side of the ears; and a pair of infraorbital stripes from the angle of the mouth to the outer base of the ears.

There is every stage of transition, from complete absence to very strong development, of these facial stripes. A certain correlation exists between the development of the supraorbital and infraorbital stripes; very strong supraorbital stripes are almost always associated with well-marked infraorbital stripes, faint supraorbital stripes with completely wanting or indistinct infraorbital stripes. The infraorbital stripes are, almost invariably, markedly fainter (narrower, or more indistinct) than the supraorbital stripes.

Immature individuals have the facial stripes less well marked than adult or aged examples. As to fully adult and aged individuals, there is a difference in the development of the facial stripes between the northern and southern races, and a difference

between dark-coloured and light-coloured specimens:—Of 59 fully adult examples (skins) of the northern races, 53 have the supraorbital stripes perfectly wanting or but very faintly indicated; in 4 they are distinct, in 2 strong; compare with this the southern races: of 53 fully adult examples (skins) 3 have these stripes faint (or quite undeveloped), 1 distinct, and no less than 49 strong or very strong. In all individuals of the northern races the infraorbital stripes are quite wanting or, at most, very faintly indicated; in more than half the number of skins of the southern races (32 of 53) they are also faint or undeveloped, but in 15 they are distinct, and in 6 strong.—That strong facial stripes are much more frequently associated with light than with dark colour of the fur is proved by the following statistics:—Of the dark-coloured individuals of the northern races scarcely 5 p. ct., of the light-coloured individuals of the same races about 25 p. ct., have the supraorbital stripes well developed; of the dark-coloured individuals of the southern races 75 p. ct., of the light-coloured individuals 100 p. ct., have the supraorbital stripes well developed.—More extensive material than I have been able to bring together may, of course, alter these figures somewhat, in one or other direction, but it is not likely that it will alter the general conclusion to any essential degree.—The subjoined table gives the details (compare diagram p. 259).

From the two facts, viz. (1) that the facial stripes are less developed in immatures than in adults, less developed in the dark

Facial stripes.

	Total number of skins of adults.	Supraorbital stripes			Infraorbital stripes		
		none or faint.	distinct.	strong or very strong.	none or faint.	distinct.	strong or very strong.
parvipes, dark	8	8	0	0	8	0	0
„ light	1	0	1	0	1	0	0
yucatanicus, dark ...	6	6	0	0	6	0	0
„ light ...	3	2	1	0	3	0	0
jamaicensis, dark ...	27	26	1	0	27	0	0
„ light ...	9	8	1	0	9	0	0
æquatorialis, dark...	3	2	0	1	3	0	0
„ light...	2	1	0	1	2	0	0
lituratus, dark	10	3	0	7	9	1	0
„ light	20	0	1	19	12	4	4
palmarum, dark.....	2	0	0	2	1	1	0
„ light.....	21	0	0	21	10	9	2
N. races, dark	44	42	1	1	44	0	0
„ light	15	11	3	1	15	0	0
S. races, dark.....	12	3	0	9	10	2	0
„ light	41	0	1	40	22	13	6

than in the light colour type, and (2) much less developed in the northern than in the southern races, I conclude that the former, also in this respect, occupy a rather lower stage in the scale of evolution *.

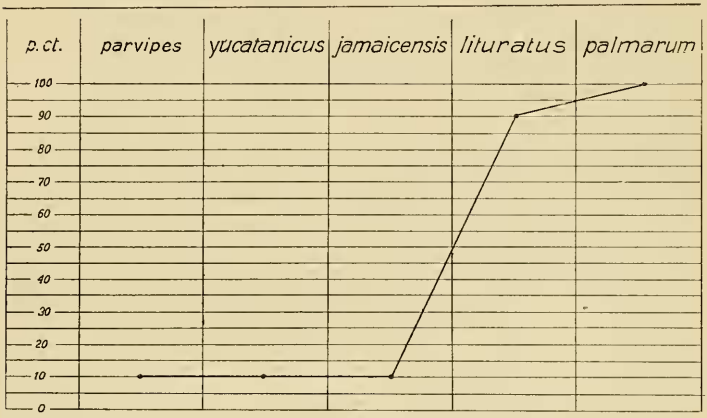


Diagram showing the percentage of individuals, in some races of *Artibeus jamaicensis*, in which the supraorbital stripes are distinct, strong, or very strong.

Concluding remarks on the colour.—The facts recorded above may be briefly summed up as follows:—Adult and aged individuals are dark smoky brown on the upper side (dark extreme), or Vandyck-brown (intermediate stage), or Prout's brown (light extreme), or some shade of brown intermediate between these three. Dark colour is, in all races, more common in younger adults than in aged adults. Dark-coloured individuals are predominant in *A. j. parvipes*, *yucatanicus*, *jamaicensis*, and *aequatorialis* ("northern" races), light-coloured in *A. j. lituratus* and *palmarum* ("southern" races). Facial stripes are commoner and more strongly developed in aged individuals than in immature and young adults; commoner and more strongly developed in light-coloured than in dark-coloured individuals; commoner and stronger in the southern races than in the northern. There is a certain correlation in the development of supra- and infraorbital stripes: when the former are strong, the latter are as a rule rather well marked or, at least, not quite obsolete; when the former are rather indistinct, the latter are as a rule wanting.

* Generally speaking, facial stripes are no doubt a very primitive feature among Vertebrates, going back, as it does, to Reptiles (and being present in a vast number of Birds). But each particular case cannot, of course, be considered only from this general point of view. As a matter of fact, the *young* individuals of *A. jamaicensis* s. lat. have, as pointed out above, the facial stripes much less developed than the adults, and we are therefore compelled to assume that this primitive feature has, for some reason or other, been lost in that type of Bat (or its predecessors) from which the living *A. jamaicensis* originated, and that now there is again a tendency to reversion to the old feature in adult individuals.

Range.—From S. Brazil, Paraguay, and Peru, to Central Mexico (Jalisco), including the West Indies; no indisputable record from Guiana.

Races.—Seven races of *Artibeus jamaicensis* are described below, viz., *A. j. parvipes*, *yucatanicus*, *jamaicensis*, and *æquatorialis*; these four, as being probably of Central American and West Indian *origin*, may be conveniently called the "northern" races; further, *A. j. lituratus*, *palmarum*, and *præceps*; these three, as being probably of South American origin, may be called the "southern" races.

Remarks.—*A. jamaicensis* is at once distinguishable from all other species of the genus by the combination of these two characters: molars $\frac{2}{3}$, maxillary tooth-row 9·3–12·2 mm.; the first character excludes all species with the exception of *A. glaucus* and *watsoni*, which possess a small m_3; the second character excludes the two latter species, *A. glaucus* and *watsoni* being very much smaller (maxillary tooth-row 6·5–7 mm.)

There is no reliable *external* character by which *A. jamaicensis*, all races taken together, can be discriminated from *A. planirostris* s. lat.; the nose-leaves, ears, wing-structure, coloration, even the dimensions, are practically identical; to the larger races of *A. jamaicensis* (*lituratus*, *palmarum*) correspond the large *A. planirostris fallax*; to the small races of *A. j. jamaicensis* (*parvipes*, *yucatanicus*, *jamaicensis*) the small races of *A. planirostris* (*planirostris*, *trinitatis*, &c.); *A. jamaicensis* might properly be described as an "*A. planirostris*" which has permanently lost m^3. Dobson's way of discriminating the two species externally—the front margin of the horseshoe free in *A. planirostris*, bound down to the muzzle in "*A. perspicillatus*" (*A. jamaicensis*)—would in 66 p. ct. of cases lead to wrong or doubtful identification.

But the matter becomes rather different when considering each race of *A. jamaicensis* separately. Brazil is inhabited by the large *A. j. lituratus*, whereas the race of *A. planirostris* occurring in the same region (*A. p. planirostris*) is considerably smaller, so that only in very rare instances is there any difficulty at all in discriminating these two forms. Guiana is inhabited by the largest race known of *A. planirostris* (*A. p. fallax*); *A. jamaicensis* is as yet not recorded with certainty from Guiana, and perhaps it has not spread to that country. In Venezuela much the same contrast obtains as in Brazil, *A. j. palmarum* being as a rule considerably larger than *A. p. planirostris*. *A. jamaicensis* has spread over the whole of the West Indies (*parvipes*, *jamaicensis*, *præceps*); *A. planirostris* is totally absent from the West Indies proper, having spread only over the Venezuelan coast islands as far as Grenada. Only Central America and Mexico are inhabited by certain small forms of *A. jamaicensis* (*jamaicensis*, *yucatanicus*) which externally, as a rule, are so completely like the small race of *A. planirostris* (*planirostris*) living in the same region, as not to be distinguishable without an examination of the teeth.

Artibeus jamaicensis parvipes Rehn.

1828. *Phyllostoma Jamaicense* Leach, Horsfield, Zool. Journ. iii. (April to July, 1827) pp. 238–40.—Macleay's specimens from Cuba.
1872. ?*Artibeus perspiccilatune* (sic), C. J. Maynard, Bull. Essex Inst. iv. no. 10, p. 144 (Oct. 1872).—Key West, Florida.
1878. *Artibeus perspicillatus* (partim, not L.), Dobson, Cat. Chir. Brit. Mus. pp. 519–20.
1878. *Artibeus macleayii* Dobson (from Gray's MS.), op cit. p. 520, specimens *h–k*.—Cuba.—Nomen nudum.
1902. *Artibeus parvipes* Rehn, Proc. Ac. N. Sci. Philad. pp. 639–40 (12 Oct. 1902). —Type locality: Santiago de Cuba.

Diagnosis.—The smallest form of *A. jamaicensis*: zygomatic width of skull 15·5–17 mm. (average 16·1); maxillary tooth-row 9·3–10 mm. (average 9·7); forearm 54–60 mm. (average 56·8).

General characters.—The angular emargination between cusps 5 and 7 of m^2 is generally as well marked as in any *A. planirostris*. The coloration of the fur of the upper side is generally of the dark type, but light-coloured individuals occasionally occur. The facial stripes are usually obsolete or faint.

A. j. parvipes and *yucatanicus*.—There is only a rather small average difference between *A. j. parvipes* and *A. j. yucatanicus*. The skull of *parvipes* is generally a trifle smaller (total length 26·9 mm., as against 27·4 mm. in *yucatanicus*) and more delicately built (zygomatic width 16·1 mm., against 16·8 mm.); the difference in the size of the teeth is infinitesimal (maxillary tooth-row 9·7 mm., against 9·9 mm.). The forearm and metacarpals of *parvipes* average 2·5 to 3 mm. shorter than in *yucatanicus*; also the phalanges, the tibia and foot average a little shorter. (See the detailed measurements, p. 264.) Being in every respect, save their average dimensions, perfectly similar, *A. j. parvipes*, and *yucatanicus* are, in many cases, practically indistinguishable, if the precise locality in which the specimens were obtained is unknown.

A. j. parvipes and *jamaicensis*.—Although there is no absolute difference between *A. j. parvipes* and *j. jamaicensis*, the former is as a rule easily distinguished by its smaller and slenderer skull and smaller teeth. Externally there is the same average difference in dimensions between *parvipes* and *jamaicensis* as between *parvipes* and *yucatanicus*.

Specimens from different localities.—There is no difference between examples from Eastern and Western Cuba.

Supposed occurrence at Key West, Florida.—While at Key West Island, south of Florida, in the early winter of 1870, Mr. C. J. Maynard watched several large bats flying about the city; the single specimen secured has since been lost, but a drawing made by Maynard enabled the late Dr. Harrison Allen to identify the species as "*Artibeus perspicillatus* Linné."* The Key West bats, Maynard writes, "closely resembled in flight a species which I had seen in Northern Florida two years before." If

* Gerrit S. Miller, Jr., Proc. Bost. Soc. N. H. vol. xxviii. no. 7, p. 214, March 1898.

the identification is correct, it appears natural to suppose that the Key West bat was *A. j. parvipes*, and that, consequently, the range of this form extends to the islets between Cuba and Florida, perhaps to peninsular Florida, the flora and fauna of the southern part of which has, as well known, a subtropical character.

Specimens examined.—25 specimens (9 skins) and 12 skulls, from the following localities :—

British Museum :—Cuba (4). Skulls of 3 specimens.

U.S. National Museum * :—W. Cuba : El Guama (3); San Diego de los Baños (5); Guanajay (6); Mariel (1).—E. Cuba : Baracoa (2); El Cobre (4).—9 skulls from practically all the localities enumerated.

Range.—Cuba, perhaps extending to Florida.

Rehn's *A. parvipes*, 1902.—Stated to differ from the Jamaican *A. jamaicensis* "in the smaller forearm and tibia, and the narrower and lighter built foot"; forearm on average "53·7 mm." (in *jamaicensis* "58·3 mm."), tibia "20·8 mm." (*jamaicensis* "21·9 mm."), foot in the type "14 mm." (in a *jamaicensis* "15 mm."). "The second upper premolar is broader and with a heavier internal shoulder, the teeth being actually broader than [in] *jamaicensis*, though the latter possesses a slightly larger skull."

As to the external characters given by Rehn, it must be said,—first, that there is no definite line of separation between the Cuban *A. parvipes* and the Jamaican *A. j. jamaicensis* : I have seen examples of *jamaicensis* with the forearm only 57 mm. long, and examples of *parvipes* with the forearm 60 mm. ; in *jamaicensis* the lower leg is occasionally only 22 mm., in *parvipes* sometimes 23 mm. ; in some *jamaicensis* the foot measures only 15·2 mm. in length, in some *parvipes* as much as 16·8 mm. Second, the average measurements calculated by Rehn from six *parvipes* and six *jamaicensis* give a somewhat exaggerated idea of the difference in size between the two races ; compare the table of measurements, p. 284. Third, since especial stress was laid by Rehn on the smaller foot in *parvipes* (see his paper), it may be well to emphasise that this is perhaps the least conspicuous of the external differences ; the average difference in this respect between the two forms is so small (0·7 mm.), and the actual measurements so frequently overlapping each other, that it would only in a small minority of cases be possible to distinguish the two forms by the size of the foot ; the smaller foot in *parvipes* is simply a consequence of the smaller size of the animal ; a closer study of the table of measurements (p. 284) will show that *proportionately* the foot of *parvipes* is precisely of the same size as in *jamaicensis*.—The dental difference mentioned by Rehn must either have been derived from an individual aberration in the specimen examined by him,

* U.S. N. M. nos. 103621-22, 103627, 103631, 103640, 103643, 103670, 103692-95, 103725-26, 103733-34, 113758, 113761, 113823, 113834-36.

or it must be a mistake; as a matter of fact, the structure of the teeth in *parvipes* is exactly as in *jamaicensis*, but the size of the teeth on an average slightly smaller; and the heel of p^4 is, as might be expected from this, not larger, but on average a trifle smaller than in *jamaicensis*.

Artibeus jamaicensis yucatanicus J. A. Allen.

1888. *Artibeus perspicillatus* (partim, not L.) Thomas, P. Z. S. p. 129 (21 Feb. 1888).—Cozumel Island (Yucatan).
1897. *Artibeus perspicillatus* (partim, not L.) J. A. Allen & Chapman, Bull. Am. Mus. N. H. ix. Art. i. pp. 3–5 (23 Feb. 1897).—Yucatan.
1904. *Artibeus yucatanicus* J. A. Allen, Bull. Am. Mus. N. H. xx. Art. 20, pp. 232–33 (29 June, 1904).—Type locality: Chichen Itza (Yucatan).

Diagnosis.—Similar to *A. j. parvipes*, but skull and external dimensions averaging a little larger. Zygomatic width of skull 16·3–17·2 mm. (average 16·8); maxillary tooth-row 9·7–10·2 mm. (average 9·9); forearm 56–61 mm. (average 59·6).

General characters.—The angular emargination between cusps 5 and 7 of m^2 is usually as well marked as in any *A. planirostris*, but individuals occur in which it is distinctly reduced in size. The coloration of the fur of the upper side is generally of the dark type, but light-coloured examples are not rare, especially among individuals with somewhat worn teeth. The facial stripes are usually obsolete or faint.

A. j. yucatanicus and *parvipes.*—The skull of *A. j. yucatanicus* is generally a trifle larger (total length 27·4, as against 26·9 mm. in *parvipes*) and, especially, broader (zygomatic width 16·8 mm., against 16·1 mm.); the difference in the size of the teeth is infinitesimal. The forearm and metacarpals of *yucatanicus* average 2·5 to 3 mm. longer than in *parvipes*; also the phalanges, tibia, and foot average a little longer. See the detailed measurements, p. 264.—The two races come so extremely close to each other, and are practically so difficult to discriminate that, were it not for their different habitat, they ought not to be kept separate.

A. j. yucatanicus and *jamaicensis.*—*A. j. yucatanicus* forms a transition between the Cuban *A. j. parvipes* and the Central American (and Mexican, and West Indian) *A. j. jamaicensis*. Externally *yucatanicus* is indistinguishable from *jamaicensis*, there being not even an average difference in size; but in the size of the skull and teeth it is decidedly nearer to *parvipes* than to *jamaicensis*.

Specimens examined.—14 specimens (7 skins) and 11 skulls, from the following localities:—

British Museum:—N. Yucatan (1); Cozumel I. (1).—Skulls of both specimens.

U.S. National Museum*:—Yucatan (4); Merida, Yucatan (1); Progreso, Yucatan (3); Chichen Itza, Yucatan (3); Belize (1).—9 skulls, from all the localities enumerated.

* U.S. N. M. nos. 11445 (37547), 108153–55, 108489–91, 143119–22.

Range.—Yucatan, including the coast islands. The only specimen examined from Belize is referable to *A. j. yucatanicus*. Certain specimens from Campeche come very near to this race.

J. A. Allen's *A. yucatanicus*, 1904.—In 1897 (*l. s. c.*), Allen and Chapman recorded four specimens of "*Artibeus perspicillatus*" (*A. jamaicensis* Leach; *A. carpolegus* Gosse) from Chichen Itza, Yucatan. In 1904 (*l. s. c.*), Allen selected one of these examples as the type of a new species, *A. yucatanicus*. In size and colour, he writes, it resembles "the West Indian forms of the genus, especially *A. parvipes* of Cuba, from which it is not readily distinguishable"; "four skulls of *A. parvipes* measure the same [viz. 27 mm.] in total length, but a little less in zygomatic width." Allen does not enter into further details as to the differential characters of the new species. (The forearm measures, according to Allen, 55 mm., the third metacarpal 57 mm.; the latter must, of course, be a misprint, if the former is correct.)

Measurements of A. j. parvipes *and* yucatanicus.

	A. j. parvipes. 25 adults, 12 skulls.			*A. j. yucatanicus.* 14 adults, 12 skulls.		
	Min.	Max.	Med.	Min.	Max.	Med.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length, to front of c...	26	27·3	26·9	26·2	28·3	27·4
„ mastoid width	14	15	14·4	14·2	15	14·6
„ width of brain-case	11·8	12·8	12·1	11·7	12·8	12·3
„ zygomatic width	15·5	17	16·1	16·3	17·2	16·8
„ maxillary width, across m^1	11·2	12·3	11·8	11·5	12·8	12·1
„ across cingula of canines	7·2	8	7·5	7·3	8	7·7
Mandible, to front of inc.	18	19	18·4	18	19·7	18·9
Upper teeth, c–m^2	9·3	10	9·7	9·7	10·2	9·9
Lower teeth, c–m_3	10·2	10·7	10·4	10·2	11	10·7
Ear-conch, length, inner margin	13·2	15·5	14·4	14	14·5	
„ length, outer margin	19	21·5	20·3	19·8	21	
„ width	13	15·5	14·2	13·7	13·7	
Tragus, length	6·2	7·2	6·8	6·8		
Lancet, length	8·5	10	9·3	8·5	9	
„ width	6	7	6·4	7	7·5	
Horseshoe, width	6·2	8	7·3	7·5	7·8	
Forearm	54	60	56·8	56	61	59·6
Pollex	12·5	14·5	13·9	13·2	14·3	13·7
3rd metacarpal	48	55	51·3	50	55·2	53·8
III^1	13·5	18	16·3	16·2	18·8	17·2
III^2	24·5	29·5	27·3	26·7	30·2	28·8
III^3	12·8	16·8	14·5	13·2	15·2	14·6
4th metacarpal	47·2	53·8	50·2	48·8	54·7	53
IV^1	12·2	15·8	14·5	14	16·3	15·3
IV^2	16·2	20·5	17·9	17·8	20·7	19
5th metacarpal	48·2	56	51·9	50	56	54·5
V^1	10·7	12·2	11·3	10·8	12·8	11·7
V^2	12	15	13·6	13	16	14·6
Interfemoral	10	17	14·1	14·8		
Lower leg	20·7	23	21·6	21·3	23	22·2
Foot, with claws	14	16·8	15·4	14·2	17	15·7
Calcar	5·2	7·3	6·4	5·8	6·2	

As already pointed out above, *A. j. yucatanicus* is similar to *A. j. parvipes* and *jamaicensis* in every respect but a small *average* difference in size; in the size of the skull and teeth it comes extremely near to the former race, in external dimensions it is indistinguishable from the latter. *A. j. yucatanicus* therefore, cannot be considered a distinct species; it forms, in its characters as in its geographical habitat, a transition between the two races, and is in some cases practically inseparable from either.

Artibeus jamaicensis jamaicensis Leach.

1821. *Artibeus Jamaicensis* Leach, Trans. Linn. Soc. xiii. pt. i. p. 75 (read 7 March, 1820).—Type locality: Jamaica.
1821. *Madatæus Lewisii* Leach, t. c. pp. 81–82.—Type locality: Jamaica.
1851. *Artibeus carpolegus* Gosse, A Naturalist's Sojourn in Jamaica, pp. 271, 272 (footnote), pl. vi. fig. 5.—Type locality: Jamaica.
1861. *Arctibeus perspicillatus* (not L.) Tomes, P. Z. S. (26 Feb. 1861) p. 64.—Jamaica (W. Osburn's specimens).
1865. *Arctibeus carpolegus* Gosse, W. Osburn, P. Z. S. (24 Jan. 1865) pp. 64–67.—Jamaica (habits).
1865. *Arctibeus jamaicensis* Leach, Peters, MB. Akad. Berlin (13 July 1865), p. 356.
1878. *Artibeus perspicillatus* (partim, not L.) Dobson, Cat. Chir. Brit. Mus. pp. 519–20.—Jamaica, S. Domingo, Mexico, Central America (partim).
1889. *Dermanura eva* Cope, American Naturalist, vol. xxiii. no. 266, p. 130 (Feb. 1889).—Type locality: St. Martins, W.I.
1890. *Artibeus coryi* J. A. Allen, Bull. Am. Mus. N. H. iii. no. i. p. 173, cf. pp. 171–72 (14 Nov. 1890).—Type locality: St. Andrew's I.
1896. *Artibeus perspicillatus* (not L.) Elliot, Field Col. Mus., Zool. Ser. vol. i. no. 3, p. 82 (May 1896).—San Domingo, W.I.
1902. *Artibeus intermedius* J. A. Allen (partim), Outram Bangs, Bull. Mus. Comp. Zool. xxxix. no. 2, p. 50 (April 1902).—Bogava, Chiriqui (the smaller specimens).
1904. *Artibeus insularis* J. A. Allen, Bull. Am. Mus. N. H. xx. Art. 20, pp. 231–32 (29 June, 1904).—Type locality: St. Kitts, W.I.

Diagnosis.—Similar to *A. j. yucatanicus*, but the skull, on average, a little larger and more heavily built, the teeth a little larger. Zygomatic width 16·2–18·2 mm. (average 17·4); maxillary tooth-row 9·8–11 mm. (average 10·3); forearm 56·5–65 mm. (average 60·1).

General characters.—The angular emargination between cusps 5 and 7 of m^2 (reminiscent of the missing m^3) is in 75 p. ct. of the large number of skulls examined as strongly pronounced as in any of those species (*A. concolor, planirostris, hirsutus*) which possess an m^3; in only about 20 p. ct. it is distinctly reduced in size, and in 4 or 5 p. ct. it has almost disappeared. The coloration of the fur of the upper side of the body is generally of the dark type, even in individuals with somewhat worn teeth; specimens of the light colour type are rare among full-grown individuals with unworn teeth, become rather more common among those with somewhat worn teeth, and appear to be predominant among those with much worn teeth. The supraorbital stripes are almost always undeveloped or faint, rarely distinct, never (so far as the available material goes) very strong; the infraorbital stripes are always undeveloped or faint.

A. j. jamaicensis *and closely allied forms.*—Neither in structure

nor in colour is there any difference between *A. j. jamaicensis* and its closest allies, *A. j. yucatanicus* and *parvipes*; but there is a distinct average difference in size, small though it is. The details have been briefly commented upon in the descriptions of the two latter races (pp. 261 and 263), and are expressed in the table of measurements, p. 284.

Specimens from different localities.—*A. j. jamaicensis* covers a much wider area than the two foregoing races (*yucatanicus*, *parvipes*). It is distributed over the whole of Central America, including the outlying small islands (St. Andrew's, Old Providence), and S. Mexico, at least as far as Morelos; further, over Jamaica, San Domingo, Porto Rico, and the smaller islands east of this latter, at least as far as St. Kitts. I have carefully compared specimens (skulls, spirit-specimens, skins) from all these places, and am unable to find the slightest indication of a difference. It is very easy, indeed, to contrast a smaller-skulled (smaller-toothed) individual from one place with a larger-skulled (larger-toothed) from another continental place or another island, a smaller-winged with a larger-winged, a darker-coloured with a lighter-coloured, or a specimen with short with a specimen with long interfemoral. When material is scarce, differences of this kind may very easily lead (and, in fact, have led) to separation of different forms or even species; but whenever the various localities have been represented by a sufficiently extensive series in the material examined by me (as has been the case with Central America, S. Mexico, Jamaica, Porto Rico, St. Andrew's Island, Old Providence Island), I have found the range of individual variation to be precisely the same within each particular locality; there is no difference whatever in structure nor in coloration, and there is not even an average difference in size.

In the comparative table of measurements below (p. 269) the specimens have been arranged under seven headings, viz., Central America (Panama, Nicaragua, Honduras, Ruatan I., Guatemala), S. Mexico (Campeche, Chiapas, Tehuantepec, Oaxaca, Vera Cruz, Morelos, "Mexico"), Jamaica, Porto Rico, San Domingo, St. Kitts, St. Andrew's and Old Providence Islands. From each of these seven areas are given the minimum, maximum, and average measurements (the latter not for the few available specimens from San Domingo and St. Kitts). The table shows the complete accordance in the size of individuals from these seven areas.

To prevent wrong identification it is important to emphasise that *Central America is inhabited by two races*, which ought not to be (but hitherto have always been) confused, viz. the smaller (truly indigenous) *A. j. jamaicensis* and the larger *A. j. palmarum* (an immigrant from south).

Specimens examined.—105 specimens (58 skins) and 76 skulls, from the following localities:—

British Museum:—Nicaragua: Corinto (1).—Honduras: Half-Moon Key (1); Ruatan Island (5).—Guatemala: Dueñas (1).—"Mexico" (1).—St. Andrew's Island (3).—Jamaica (17).—San

Domingo (2).—Porto Rico (2).—29 skulls, from all the localities enumerated.

U.S. National Museum* :—Panama : Colon (1).—Nicaragua : Greytown (1); Escondido River, 50 miles from Bluefields (1).—Guatemala : Peten (1).—Campeche : Apazote, near Johallun (4).—Chiapas : Palenque (7); San Bartolomé (4); San Vicente (4).—Tehuantepec (1).—Oaxaca : Santo Domingo (4).—Vera Cruz : Tuxtla (1); Mirador (1).—Morelos (3).—Old Providence Island (5).—Jamaica, various places (9).—San Domingo (1).—Porto Rico, various places (23).—St. Kitts Island (1).—47 skulls, from all the localities enumerated.

Range.—Central America and S. Mexico, as far north as Morelos, and exclusive of Yucatan; St. Andrew's and Old Providence Islands; Jamaica, San Domingo, Porto Rico, as far east as St. Kitts.

Leach's *A. jamaicensis*, 1821.—The probable type, the skin (unregistered) of an adult individual from Jamaica ("*a*" in Dobson's Catalogue, p. 520), with skull ("*q*"), is in the British Museum.

Leach's *Madatæus lewisii*, 1821.—The type, in the British Museum (skin, with skull; unregistered; "*b*" in Dobson's Catalogue, p. 520), is a very young *A. j. jamaicensis*, sent from Jamaica by W. Lewis. The peculiarities which led Leach to regard it as a distinct species (and genus) are due to the immaturity of the individual.

Gosse's *A. carpolegus*, 1851.—Based on a ♂ ad., obtained by Gosse at Content, Jamaica, preserved in alcohol; Brit. Mus. no. 47.12.27.13. Indistinguishable from Leach's *A. jamaicensis*. The Bat now called *Ariteus achradophilus* was described by Gosse under three names :—*A. jamaicensis* Leach (of which he had only Horsfield's description in Zool. Journ. iii. (1828) p. 238 for comparison), *A. achradophilus* Gosse, and *A. sulphureus* Gosse (light phase); the true *A. jamaicensis* Leach he described under a new name, *A. carpolegus* Gosse.

Cope's *Dermanura eva*, 1889.—Founded on two adult males, from the island of St. Martins, West Indies, now in the collection of the Academy of Natural Sciences, Philadelphia. They were stated by Cope to have $\frac{2}{2}$ molars only, and therefore referred by him to the "genus" *Dermanura*; the rest of the description (lip tubercles, nose-leaves, ears, interfemoral, fur, colour, dimensions) is that of an ordinary *A. j. jamaicensis*; forearm 59, tibia 21, foot 17 mm.; no description nor measurements of the skull.—The types were re-examined by Rehn, in 1900†,

* U.S. N. M. nos.:—8671 (9387), 11187, 13220 (37912), 14305, 14410, 14412–13, 14415, 14753 (37811), 16332 (23360), 53063, 64482–83, 70431, 70453, 73225, 73265, 86280, 86282–84, 86310–15, 86349, 86352–53, 86392–93, 96182, 100192, 100199, 100202, 100204, 102458, 108025, 108232, 108234, 108236, 108238–39, 108242, 110939, 112122, 112124, 112131–34, 112136–37, 113442, 113927–29, 114038, 122430–32, 133042–45, 133050, 133052–54, 147135–36.

† James A. G. Rehn, "Notes on Chiroptera," Proc. Ac. Nat. Sci. Philad., Dec. 1900, pp. 758–59 (9 Feb. 1901).

who, on extracting the skull of one of the specimens, found it to have $\frac{2}{3}$ molars; thus the only difference between *D. eva* and *A. j. jamaicensis* to be derived from Cope's description proves to be imaginary. According to Rehn, the skull measures 27·6 mm. (total length), the zygomatic width 17, the forearm 62, tibia 24, foot 14, measurements which fall completely within the limits of *A. j. jamaicensis*. Cope found the interfemoral "notched to a line opposite the middle of the tibia"; Rehn writes that it is "of much greater expanse than either [in] *perspicillatus* or *planirostris*," and this is evidently his only reason to keep "*D. eva*" separate; but there is in this respect a very great individual variation: in 7 spirit-specimens of *A. j. jamaicensis* from Jamaica the length of the interfemoral, measured in the middle line, varies between 11·2 and 19 mm.; a similar variation is found in specimens of *A. j. jamaicensis* from other places, as well as in other races of the species. *A. j. jamaicensis* occurs west of St. Martins (Porto Rico) and east of St. Martins (St. Kitts), so that also from this point of view there is not much probability that St. Martins individuals differ from the true *A. j. jamaicensis*.

J. A. Allen's *A. coryi*, 1890.—Based on a single specimen, taken on St. Andrew's Island, Caribbean Sea, Feb. 12, 1887, by one of Mr. C. B. Cory's collectors. It was described by Allen (*l. s. c.*) as a distinct species on account of its colour:—"General color above dark seal brown (brownish black), but very little lighter at the base than at the surface; no trace of white streaks on the face." Forearm "50·1 mm." (*sic*); third metacarpal "56 mm." (or "55 mm.," see p. 171 of Allen's paper).

There are three skins of "*A. coryi*" in the British Museum, from the same island as the type specimen, taken by the same collector, on the same date. Their coloration is as described by Allen, but on examination of their teeth they prove to be youngish, though full-grown, individuals (teeth perfectly unworn); this accounts sufficiently for their dark coloration, which is indistinguishable from that of youngish specimens of *A. j. jamaicensis* from Jamaica, Porto Rico, S. Mexico, &c. (and of any other race of *A. jamaicensis*, the South American forms not excluded). The absence of facial stripes is due, partly to the fact that St. Andrew's individuals belong to the northern group of races of *A. jamaicensis*, in which these stripes are generally wanting or but faintly developed; partly to the fact that the individuals obtained by Cory are young adults, in which the facial stripes are generally wanting or still more faintly indicated than in specimens of more advanced age.—Allen's measurement of the forearm, viz. 50·1 mm., is incorrect, and the explanation of the error is no doubt this: in the three British Museum specimens the proximal part of the radius has been cut away by the taxidermist; presumably the same is the case in Allen's specimen, since it is from the same collector and place; the true length of the forearm, judging from the length of the metacarpals, would be about 60 mm., as in an average *A. j. jamaicensis*.—On p. 171

Measurements of Artibeus jamaicensis jamaicensis.

	Central America (detailed localities see p. 266). 12 adults, 9 skulls.			S. Mexico. (detailed localities see p. 266). 27 adults, 23 skulls.			Jamaica. 21 adults, 11 skulls.			Porto Rico. 23 adults, 11 skulls.			San Domingo. 3 adults, 3 skulls.		St. Kitts. 1 adult. 1 skull.	St. Andrew's Island, Old Providence Island. 8 adults. 5 skulls.		
	MIN.	MAX.	MED.	MIN.	MAX.	MED.	MIN.	MAX.	MED.	MIN.	MAX.	MED.	MIN.	MAX.		MIN.	MAX.	MED.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length, to front of c	27	29·2	28·3	27·8	29·2	28·4	27·7	28·8	28·2	27·8	29	28·5	28·2		... ...	27·2	29	28·2
„ mastoid width	14·8	15·8	15·3	14·7	16·1	15·3	14·5	15·2	14·9	14·7	15·2	14·9	14·2		14·8	14·5	15·5	15·1
„ width of brain-case	12	13	12·6	12·5	13	12·8	12	13	12·6	12	13·3	12·8	12·4		12·7	12	13	12·6
„ zygomatic width	17·2	18·2	17·6	17·2	18·2	17·5	16·7	17·8	17·4	16·2	17·8	16·9	16·7		17·2	16·5	17·8	17·2
„ maxillary width across m^1	12·2	13·2	12·7	12	13·2	12·7	12·2	13·7	12·7	12·2	13	12·4	12·2	12·6	12·2	12	12·8	12·4
„ across cingula of canines	7·8	8·8	8·2	7·7	9·1	8·2	7·8	8·6	8	7·8	8·3	8·1	7·8	8	7·8	7·7	8	7·9
Mandible, to front of inc.	18·8	20·7	19·4	19	20·2	19·6	19·2	20·2	195	19·2	20·2	19·7	19	19·3	19·6	18·8	19·8	19·3
Upper teeth, c–m^2	10	11	10·3	9·9	11	10·3	10	10·8	10·3	9·8	10·7	10·2	10	10·5	10·2	9·8	10·3	10·1
Lower teeth, c–m_3	10·8	11·7	11·2	10·7	11·5	11·1	10·7	11·5	11·1	10·7	11·8	11·1	10·8	11	10·7	10·5	11·2	11
Ear-conch, length, inner margin	13·8	15·8	14·6	14	16	15	14	15	14·7	14	15·7	14·7	14·2		15·5	14	14·5	14·4
„ length, outer margin	21	22·2	21·6	19·8	22	21·7	20	22	21·2	19·7	22	20·6	.....		.....	19·8	20·5	20·3
„ width	13·5	16	14·4	13·5	15·5	14·5	13·8	15	14·3	13·5	16	14·2	.....		15	13·5	13·8	13·7
Tragus, length	6	7·2	6·7	6·5	7·3	6·9	6·2	7·7	6·9	6·5	7·5	7·1	.....		.....	6·5	7·5	7·2
Lancet, length	8·7	10·8	9·6	9	10·8	9·7	9	10	9·6	9	10·5	9·7	9		9·5	8·2	9·5	9
„ width	6·2	7	6·7	6	7·4	6·7	6·8	7·8	7·2	6	7·5	6·7	6		6	6·2	7	6·6
Horseshoe, width	6·5	8·2	7·6	7·5	8·5	8	6·8	8	7·6	7	7·8	7·3	.....		7·5	7·5	8·5	8
Forearm	56·5	66	60	58·5	65	61·1	57	63·5	59·8	57	63	59·7	58	60	61	56·7	61	59·1
Pollex	13·2	15·7	14·2	13·2	15·5	14·5	13·5	15·3	14·2	13	15	14·1	13		.....	13	15	13·9
3rd metacarpal	51·5	58·2	53·9	51·2	61	55	50	56	53·3	50	56	53·2	53	55	52·8	52	56	53·3
III^1	16·5	19	17·4	16	20	17·7	15·8	17·8	16·9	16	18	16·8	16·2	17	17·5	17	18·8	18
III^2	26	32	29·1	26·2	32·8	29·6	26·8	31·8	28·5	26·2	30·7	28·3	26·5	29·2	28	27·8	29·5	28·3
III^3	15	17·7	16	14	17·5	15·9	14	16·5	15·4	13·7	16·2	14·7	15	16	15	14·2	17·8	15·9
4th metacarpal	50	57·2	53·1	49·5	59·8	54·1	49·5	54·8	52·6	49	54	52·1	51·7	54·2	50·8	50·5	55	52·5
IV^1	14	16·7	15·4	13·8	17·2	15·7	14	16	15	14	16	14·7	14·7	15·5	15	15·2	1 6	15·4
IV^2	16	21·5	19·1	17	20·7	19·4	17·5	20·7	19·1	17	20	18·7	...	19·2	17·8	17·7	20	18·7
5th metacarpal	52·3	58·5	54·8	51	62·5	55·7	52	57·5	54·6	51·7	56·5	54·1	53	56	53·8	52	56·2	54
V^1	11	13·7	12·2	10·8	13·8	12·2	11	12·5	11·7	11	12·8	11·7	10·8	11·5	12·2	11·8	12·8	12·2
V^2	12·8	16·2	14·7	13·2	17	15	13·5	15·3	14·3	12·7	15·2	13·9	13·7		15	13·8	15	14·3
Interfemoral	11	18·2	15·7	13	17·8	15·3	11·2	19	15·8	12·5	18	14·7	...	18·5	16·5	14	17	16
Lower leg	21	24	22·3	21·2	24·2	22·8	22	24	22·9	21·7	24	22·8	22·5	22·5	21·7	21·2	24	22·5
Foot, with claws	15·7	16·8	16·3	14·2	17·2	16·1	15·2	17	16·1	15	17·2	16	15	15·7	16·2	15	17·7	16·2
Calcar	5·7	7	6·2	5·2	7·8	6·4	6	7·5	6·5	6	7·7	6·6	6·5			6·2	6·7	6·5

of the paper quoted above, Allen writes that "*A. coryi*" "differs greatly from all others [all other forms of the "*perspicillatus*" section] in colour and in the distribution of the fur on the forearms, which on the dorsal surface extends densely in a broad band along the humeri and over about the proximal third of the forearm bones." There must be some mistake here; the distribution of the fur on the forearm in St. Andrew's specimens is as described by Allen, but so it is also in all other individuals of *A. j. jamaicensis*, from any place, I have seen, and, in fact, in all other races of *A. j. jamaicensis*.

J. A. Allen's *A. insularis*, 1904.—Type locality: St. Kitts, West Indies. "Based on a single alcoholic specimen, a very old male, in excellent preservation, but with the skull badly broken. In external measurements it agrees very well with *A. jamaicensis*, ... The skull, however, in *A. insularis* is much larger than in *A. jamaicensis*, the width across m^2–m^2 being 1 mm. (about one tenth) greater, and the rostrum at the base of the canines is also a millimetre wider, or about one eighth wider. This indicates a much larger and more massive skull than in *A. jamaicensis*, while the external measurements are about the same." "Dorsal surface pale reddish brown, paler below; membranes pale brown; no head stripes." Width of skull across m^2 13; width at base of canines 8·6; upper tooth-row (c–m^2) 11; lower tooth-row 11; forearm 61; third metacarpal 58 mm.

The specimen described by Allen is, in certain respects, a little above the average size, but all the measurements recorded fall quite within the limits of individual variation reached by *A. j. jamaicensis*; the specimen is matched, or surpassed, by a good number of *A. j. jamaicensis* from many different places. The measurement of the lower tooth-row must have been taken from the front of the canine to the back of m_2, not to the back of m_3 (or it would be greater than, not the same as, that of the upper row, from c to m^2). The measurement of the second phalanx of the third digit, stated to be 40 mm., is obviously wrong. The light colour of the fur is due to the specimen being, as said by Allen, "very old." The absence of facial stripes is a common feature in *A. j. jamaicensis*.— An example from St. Kitts examined by me (U.S. N. M. no. 110939) is in every respect (external characters, skull, teeth) indistinguishable from *A. j. jamaicensis*; it shows no approximation to *A. j. præceps*.

Artibeus jamaicensis æquatorialis, K. And.

1906. *Artibeus jamaicensis æquatorialis* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 421 (1 Dec. 1906).—Type locality: Zaruma, S. Ecuador.

Diagnosis.—Similar to *A. j. jamaicensis*, but skull, teeth, and external dimensions averaging somewhat larger. Total length of skull, to front of canines, 28·8–30 mm. (average 29·7); zygomatic width 18·2–18·5 mm. (average 18·3); maxillary tooth-row 10·8–11·2 mm. (11·0); forearm 60·8–66 mm. (62·9).

General characters.—The angular emargination in the posterior margin of m^2, between cusps 5 and 7, is generally as well marked as in any *A. planirostris*, sometimes reduced in size or almost obliterated. The coloration of the fur is, in the only adult individual available with quite unworn teeth, of the dark type, in more aged specimens often light. The supraorbital stripes are sometimes well marked; the infraorbital stripes in all specimens examined undeveloped or faint.

A. j. æquatorialis and *jamaicensis*.—The skull of *A. j. æquatorialis* averages larger, and especially broader, than in *A. j. jamaicensis*, the zygomatic width being 18·3 mm., as against 17·4 in *jamaicensis*, the maxillary width (externally, across m^1) 13·6, against 12·6, the width across the cingulum of the upper canines 8·9, against 8·1; the teeth are a little larger, the maxillary tooth-row being 11·0 mm., against 10·3. In all these respects *A. j. æquatorialis* is as much larger than *A. j. jamaicensis* as this

Measurements of A. j. jamaicensis *and* æquatorialis.

	A. j. jamaicensis. 95 adults, 65 skulls.			*A. j. æquatorialis.* 7 adults, 6 skulls.		
	Min.	Max.	Med.	Min.	Max.	Med.
	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length, to front of c	27	29·2	28·3	28·8	30	29·7
„ mastoid width	14·2	16·1	15·1	15·2	16·2	15·8
„ width of brain-case	12	13·3	12·7	12·8	13·5	13·1
„ zygomatic width	16·2	18·2	17·4	18·2	18·5	18·3
„ maxillary width across m^1	12	13·7	12·6	13·3	14	13·6
„ across cingula of canines	7·7	9·1	8·1	8·3	9·2	8·9
Mandible, to front of inc.	18·8	20·7	19·5	20·3	21·5	21·1
Upper teeth, c–m^2	9·8	11	10·3	10·8	11·2	11
Lower teeth, c–m_3	10·5	11·8	11·1	11·8	12·6	12·1
Ear-conch, length, inner margin	13·8	16	14·8	15	15·8	
„ length, outer margin	19·7	22·2	21·3	22·7	23·5	
„ width	13·5	16	14·3	14·8	15·7	
Tragus, length	6	7·7	7	7·2	7·5	
Lancet, length	8·2	10·8	9·6	9·8	11	
„ width	6	7·8	6·8	7·4	7·5	
Horseshoe, width	6·5	8·5	7·6	8·5	9	
Forearm	56·5	65	60·1	60·8	66	62·9
Pollex	13	15·7	14·2	14	15·2	14·4
3rd metacarpal	50.	61	53·7	54·5	59·5	56·9
III^1	15·8	20	17·3	17·7	19·3	18·4
III^2	26	32·8	28·8	30·3	33	30·9
III^3	13·7	17·8	15·5	16·2	17·8	16·9
4th metacarpal	49	59·8	52·9	53·7	57·2	55·4
IV^1	13·8	17·2	15·2	15·8	17·2	16·6
IV^2	16	21·5	19	19·8	22	19·9
5th metacarpal	51	62·5	54·7	54·5	59·7	57·2
V^1	10·8	13·8	11·9	12	13·2	12·8
V^2	12·7	17	14·5	14·2	17·2	15·4
Interfemoral	11	19	15·5	17·5	18·5	
Lower leg	21	24·2	22·8	22·8	26	24·1
Foot, with claws	14·2	17·7	16·1	16	17	16·8
Calcar	5·2	7·8	6·5	7	8	7·2

latter is larger than *A. j. parvipes*. The forearm and metacarpals average 2·5 to 3 mm. longer than in *A. j. jamaicensis*; thus, also in external dimensions it bears much the same relation to *A. j. jamaicensis* and *yucatanicus*, as these latter to *A. j. parvipes*. For further details see the tables of measurements pp. 271 and 284.

Geographically there is, in the series of *jamaicensis* and *æquatorialis* available, a break between the former and the latter. I have had no specimen of *jamaicensis* from any place south of Panama (Colon), and none of *æquatorialis* north of S. Colombia (Cali); but there cannot be much doubt that further investigations will fill up this gap, so that there, also geographically, will prove to be a perfect transition between *A. j. jamaicensis* and its southern representative, *A. j. æquatorialis*.

Specimens examined.—9 specimens (8 skins) and 8 skulls, from the following localities:—

British Museum:—Zaruma, S. Ecuador (6). Cali, S. Colombia (2).—7 skulls, representing both localities.

U.S. National Museum*:—Corondelet, N. Ecuador (1, with skull).

Range.—As yet known only from the region between Zaruma, S. Ecuador, and Cali, S. Colombia.

Artibeus jamaicensis lituratus Licht.

1801. *Chauve-souris première* ou *Chauve-souris obscure et rayée*, Azara, Essais sur l'histoire naturelle des Quadrupèdes de la province du Paraguay, ii. pp. 269–70.—Paraguay.
1815. *Phyllostomus lituratus* Illiger, Abh. Akad. Berlin, 28 Feb. 1811 (issued 1815), p. 109.—Nomen nudum.
1823. *Phyllostomus lituratus* Ill., Lichtenstein, Verz. Doubl. Berlin. Mus. p. 3.—Brazil.
1826. ? *Phyllostoma superciliatum* Wied, Beitr. Naturg. Bras. ii. pp. 200–202.—Type locality: Rio de Janeiro.
1830. *Phyllostoma superciliatum* Wied, Rengger, Naturg. Säugeth. Paraguay, pp. 74–75.—Paraguay.
1840. *Phyllostoma perspicillatum* (partim, not L.) Wagner, Schreber's Säugthiere, Suppl. i. pp. 403–5.—Spix's type of "*Ph. planirostre*" compared with Spix's specimens of *A. j. lituratus*.
1878. *Artibeus perspicillatus* (partim, not L.) Dobson, Cat. Chir. Brit. Mus. pp. 519–20.—Brazil, Bolivia, Colombia.
1878. *Artibeus grandis* Dobson (from Gray's MS.), op. cit. p. 250, specimen k^1.—Nomen nudum.
1892. *Artobius perspicillatus* (not L.) Winge, Jordfundne og nulevende Flagermus fra Lagoa Santa, Minas Geraes, Brasilien; E Museo Lundii, ii. pt. 1, p. 10, pl. i. fig. 13.—Minas Geraes.
1900. *Artibeus lituratus* Licht., Thomas, Ann. Mus. Civ. Genova (2) xx. p. 547 (4 July, 1900).—Parana.
1901. *Artibeus jamaicensis* Leach, Thomas, Ann. & Mag. N. H. (7) viii. p. 192 (Sept. 1901).—Para.
1901. *Artibeus lituratus* Licht., Thomas, Ann. & Mag. N. H. (7) viii. p. 441 (Nov. 1901).—Paraguay.
1904. *Artibeus rusbyi* J. A. Allen, Bull. Am. Mus. N. H. xx. Art. 20, pp. 230–31 (29 June, 1904).—Type locality: Yungas, "Peru" (probably a slip for Bolivia).

Diagnosis.—In all essential respects similar to *A. j. jamaicensis*, but considerably larger. Total length of skull 30·5–34 mm.

* U.S. N. M. no. 113363.

(average 32·2); zygomatic width 18·8–20·2 mm. (average 19·4); maxillary tooth-row 10·7–12·2 mm. (11·7); forearm 64–73·5 mm. (70·2).

General characters.—This is the first of the three very closely related southern races of *A. jamaicensis* described in this paper. The southern group (*A. j. lituratus*, *palmarum*, *præceps*) differs from the northern (*A. j. parvipes*, *yucatanicus*, *jamaicensis*, *æquatorialis*) chiefly in the following points:—

The angular notch in the posterior margin of m^2, between its cusps 5 and 7, is rather rarely as well marked as in *A. planirostris*; generally (in about 90 p. ct. of 68 skulls examined) it is either noticeably reduced or completely filled up; in the latter case the bulk of m^2 has been increased by an area more or less corresponding to that of the missing m^3. By advancing age the sagittal crest of the skull is produced considerably forward, the supraorbital ridges directed almost straightly outward, the post-orbital and anteorbital processes conspicuously developed,—as described in detail and figured on p. 248. The dimensions are, generally, in every respect larger, sometimes (especially in *A. j. lituratus* and *palmarum*) considerably larger. The colour in full-grown individuals with unworn or practically unworn teeth is, most often, of the dark type, rather often, however, light; at a higher age the majority of individuals are light-coloured. The supraorbital stripes are, as a rule, well marked, often very strong, rather rarely faint or obsolete; the infraorbital stripes not rarely well developed.

A. j. lituratus, *jamaicensis*, and *æquatorialis*.—There is very rarely any difficulty in discriminating *A. j. lituratus* from *A. j. jamaicensis*. The skull averages almost 4 mm. (14 p. ct.) longer, and 1·5–2 mm. (14 p. ct.) broader, the tooth-rows 1·4–1·7 mm. (about 14 p. ct.) longer than in *A. j. jamaicensis*; the forearm and metacarpals average nearly 10 mm. (16–18 p. ct.) longer. Even the very smallest individuals of *A. j. lituratus* have, almost always, the skull and teeth in some direction or other more heavily built than in the largest individuals of *A. j. jamaicensis*. When, further, it is taken into consideration that there is absolutely no overlapping of the geographical areas occupied by these two races, a confusion becomes practically impossible.

A. j. æquatorialis is generally a little larger than *A. j. jamaicensis*, and, consequently, comes a little nearer to *A. j. lituratus* in size; but the average difference between *æquatorialis* and *lituratus* is still very great, the absolute difference as a rule well marked. *A. j. lituratus* extends into the area inhabited by *A. j. æquatorialis*, but individuals which cannot be referred with certainty to either the one or the other form seem, even in the region common to both, to be very rare.

A. j. lituratus cannot be separated as a distinct species. First, individuals do occur, though rarely, that cannot, by their characters alone (*i. e.* apart from their habitat), be discriminated with certainty from some individuals of *A. j. æquatorialis* and *jamaicensis*;

second, *A. j. palmarum* and *præceps* completely overbridge the gap (if gap it be called) between *lituratus* and *jamaicensis*.

On the difference between *A. j. lituratus* and *palmarum* see this latter form.

Specimens examined.—54 specimens (42 skins) and 42 skulls, from the following localities :—

British Museum :—Paraguay : Sapucay (7) ; Asuncion (1).—Sta. Catharina (1).—Parana : Morretes, Serra do Mar, 10 m. (5) ; Palmeira (1).—S. Paulo : Cruzeiro, 530 m. (5).—Minas Geraes : Sete Lagoas (1).—Bahia ; Samarão, 300 m. (2).—Para (2).—" Brazil " or uncertain localities (6).—Colombia : Cali (4) ; Bogota region, various places (4) ; " Colombia " (2).—36 skulls, from all the localities enumerated.

U.S. National Museum* : Paraguay : Sapucay and Villa Rica (9). —Sta. Catharina (1).—N. Ecuador : Pambilar (1).—S. Colombia : Cali (2).—6 skulls, representing all these localities.

Range.—Paraguay, Brazil, Ecuador, S. and Central Colombia.

Linné's *Vespertilio perspicillatus*, 1758 †.—As pointed out by Oldfield Thomas in 1892 and 1901 ‡, Linné's *V. perspicillatus* was based primarily on Seba's " *Vespertilio Americanus vulgaris* " §, which is the bat commonly called *Carollia brevicauda*.

Schreber's *V. perspicillatus* ‖ is probably also *Carollia* ; the presence of a tail (" ganz in die Schwanzhaut eingeschlossen, und so kurz, dass er noch nicht an die Hälfte ihrer Mitte reicht ") excludes at all events the genus *Artibeus*.

Geoffroy's *Phyllostoma perspicillatum* ¶ from Guiana is either *A. planirostris* or one of the large races of *A. jamaicensis*, which of these two species cannot be decided from the description. The species commonly brought by collectors from Guiana is *A. planirostris* ; if Geoffroy's bat is an *A. jamaicensis*, it is the only record known to me of this species from Guiana. The figure has the front of the horseshoe completely confluent with the integument of the muzzle.

Wagner's description of " *Phyllostoma perspicillatum* " (1840, *l. s. c.*) was based on Spix's type of *Ph. planirostre* and two specimens of *A. jamaicensis lituratus*, all of which had been obtained by Spix at Bahia and were by Wagner taken to be " types " of *Ph. planirostre* ; see pp. 238–239 of this paper.

Dobson's *Artibeus perspicillatus* (1878, *l. s. c.*) is the species here called *A. jamaicensis*.

Azara's *Chauve-souris première*, 1801.—In 1901 **, Oldfield

* U.S. N. M. nos. 105587, 105625–26, 113362, 113364–65, 115065, 121445, 121447, 121466–67, 121469, 122139.

† Syst. Nat. ed. 10, i. p. 31 (1758).

‡ Thomas, P. Z. S. 1892, p. 315 ; Ann. & Mag. N. H. (7) viii. p. 192 (Sept. 1901).

§ Seba, Thesaurus, i. p. 90, pl. lv. fig. 2 (1734).

‖ Schreber, Säugthiere, i. pp. 160–61, pl. xlvi. A (1775).

¶ Geoffroy, Ann. Mus. d'Hist. Nat. xv. pp. 176–77, 186, pl. xi, upper right figure (1810).

** Thomas, Ann. & Mag. N. H. (7) viii. pp. 441, 443 (Nov. 1901).

Thomas called attention to the identity of Azara's "Chauve-souris première ou Chauve-souris obscure et rayée" with Lichtenstein's *Phyllostomus lituratus*. The essence of Azara's description (Azara did not see this bat, but copied the description from manuscript notes by Noséda) is this: the "Chauve-souris première" is a bat, (1) of large size (length 110 mm., expanse 525 mm.), (2) with no tail, (3) with a white stripe from the nose to the ear, and (4) inhabiting Paraguay. *A. j. lituratus* is the only tailless bat of this size known from Paraguay.

Lichtenstein's *Phyllostomus lituratus*, 1823.—Based, without description, on Azara's "Chauve souris obscure et rayée." As the identity of Azara's bat is unquestionable, the name *lituratus* is technically valid.

Maximilian of Wied's *Phyllostoma superciliatum*, 1826.—Based on a single specimen found dead and much decomposed "bei der Fazenda von Tapebuçú . . . . nördlich von Cabo Frio zwischen den Flüssen S. João und Macahé," *i. e.* in the province of Rio de Janeiro. The author placed this bat ("Der Vampyr mit weissem Augenstreif") in a section of "*Phyllostoma*" headed "Unbestimmte Arten, deren Gebiss nicht untersucht werden konnte, welches aber wahrscheinlich mit dem der vorhergehenden Abtheilung übereinstimmt"; the preceding section has $\frac{5}{5}$ "Backenzähne" (*i. e.* $\frac{3}{3}$ molars). The statement is, of course, without any value, as the author admits it to be mere conjecture. In the rest of the extremely vague description there is nothing which prevents the identification of *Ph. superciliatum* with *A. j. lituratus*.

Rengger's "*Ph. superciliatum* Wied," from "Jhu," Paraguay, is no doubt *A. j. lituratus*. His specimen had no "weisse Spitzen der Flügelhaut"; but the amount of white at the tip of the wing (region of third, or second and third, phalanx of third digit) is individually very variable; examples occur in which it is but slightly indicated (very restricted, and clouded with dark colour).

Dobson's (Gray's) *A. grandis*, 1878.—The name "*Artibeus grandis*," quoted in Dobson's Catalogue from a manuscript label by Gray, but apparently never published by this latter author, refers to an unregistered spirit-specimen in the British Museum, an adult male without history; maxillary tooth-row 12 mm., forearm 70·8 mm. The specimen is indistinguishable from an ordinary *A. j. lituratus*.

J. A. Allen's *A. rusbyi*, 1904.—Based on the skin and skull of an individual from Yungas, Bolivia *, 6000 feet. *A. rusbyi* is stated, by Allen, to be "nearly related to *A. palmarum* of Trinidad and adjoining parts of north-eastern South America, but differs in the

* Allen writes, "Yungas, Peru" [*i. e.* the coast region round Trujillo, N.W. Peru]; but the specimen made by Allen, in 1904, the type of *A. rusbyi* had been mentioned, by the same author, on two previous occasions (Bull. Am. Mus. N. H. iii. (1890) pp. 170 & 172, and ix. (1897) p. 16) as being from "Yungas, Bolivia" [*i. e.* the eastern slopes of the Bolivian Cordilleras to the Amazonian plains]. I take the latter to be correct, but whether my conjecture is right or wrong is, for the identification of *A. rusbyi*, of no consequence.

lower, less convex, and more spreading brain-case, broader palate and heavier dentition, the upper tooth-row (canine and molar–premolar series) having a length of 11·5 mm. against 10·2 in *A. palmarum*; also in more prominent face stripes and darker coloration." Forearm 71 mm.; third metacarpal 69 mm.

I have had no adult specimen of the *Artibeus jamaicensis* section from Bolivia*, but nine from Ecuador, S. and Central Colombia; they accord in every respect with Allen's description of *A. rusbyi*, being at the same time perfectly indistinguishable from *A. j. lituratus*. Allen gives as length of the maxillary tooth-row in his single specimen of *A. rusbyi* 11·5 mm., as against 10·2 in "*A. palmarum*"; in so far he had good reason to separate the former. But in 6 skulls of adult individuals of *A. j. lituratus* from the type locality, viz. Paraguay, the *average* length of the maxillary tooth-row is 11·6 mm.; in 19 adult skulls of the same race from various localities in Brazil 11·7 mm.; thus precisely as in the type of *A. rusbyi*.—The explanation, why Allen regarded *A. rusbyi* as an undescribed species, is evidently this: Allen compared *A. rusbyi* not with a series of *A. j. lituratus* from Paraguay or Brazil, but with an *unusually small-toothed A. j. palmarum*. I have examined 28 skulls of *A. j. palmarum*, and 10·2 mm., given by Allen as the length of the upper tooth-row in this form, is precisely the actual minimum in the whole series. Allen found the skull of *A. rusbyi* "lower" (less convex, &c.) than in *palmarum*; it only means that the skull of the type of *A. rusbyi* is in the adolescent stage, whereas the skull (or skulls) of *palmarum* with which he compared it must have been in the stage characteristic of adult and aged individuals; that these differences in the shape of the skull are dependent on age has been pointed out elsewhere in this paper (p. 248, text-figs. 50, 51). The colour characters mentioned by Allen are of no taxonomic value; individuals of *lituratus* and *palmarum* may be dark or light, their facial stripes strong or obsolete; these variations are partly dependent on age, partly purely individual.

In the table of measurements below, p. 277, I have arranged the adult specimens of *A. j. lituratus* in three sections according to their geographical habitat, viz. Paraguay, Brazil, and Ecuador–Central Colombia. In each of these sections are given the absolute minimum and maximum and the average, chiefly in order to show that individuals from these three regions are in every respect identical in size, *i. e.* vary within the same limits. It will be noticed that the average measurements of skulls (including teeth) from the three regions are perfectly alike; that averages of external measurements of individuals from Paraguay and Brazil are alike; and that the actual measurements of skulls, teeth, and external dimensions, within all these categories are

* Specimen "*i*" in Dobson's Catalogue (p. 520), stated to be from Bolivia and "adult," is quite young; the correctness of the locality is questionable.

practically alike, when due consideration is taken of the fact that the number of individuals examined from each region is not the same. The external average measurements of the nine individuals from Ecuador, S. and Central Colombia, are somewhat larger than in the two other sections, but there is no reasonable doubt that this is quite accidental; in Paraguay individuals the difference between the absolute maximum and minimum of the length of the forearm is 9·5 mm., in the still larger Brazilian series 11 mm.; so that it is not very likely that in individuals from Ecuador and Colombia the amount of variation in this respect should be 4·5 mm. only; all of these latter individuals evidently happen to be rather large, none of them representing the minimum size, and consequently the average, as calculated from this series, is also above the true normal.

Measurements of Artibeus jamaicensis lituratus.

	Paraguay. 12 adults, 6 skulls.			Brazil (detailed localities see p. 274). 20 adults, 19 skulls.			Ecuador, S. & C. Colombia. 9 adults, 8 skulls.		
	Min.	Max.	Med.	Min.	Max.	Med.	Min.	Max.	Med.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length, to front of c	31·5	33	32·1	30·5	34	32·1	31·2	33	32
„ mastoid width	16·3	17·2	16·9	16·8	18	17·3	16·8	17·5	17·3
„ width of brain-case	13·8	14·2	14·1	13·8	15	14·1	13·8	14·8	14
„ zygomatic width	18·8	20	19·2	18·8	20·2	19·4	19·5	19·6	19·4
„ maxillary width across m^1	13·2	14·7	14·1	13·6	15·2	14·5	13·3	14·2	13·9
„ across cingula of canines	8·6	9·2	9	8·8	10	9·3	8·7	9·7	9
Mandible, to front of inc.	21·2	23·7	22·3	21·7	23·5	22·7	22	22·3	22·2
Upper teeth, c–m^2	10·7	12	11·6	10·8	12·2	11·7	11·2	12	11·5
Lower teeth, c–m_3	11·8	13·3	12·6	12·2	13·7	12·9	12	13	12·5
Ear-conch, length, inner margin	16·7	18	17·3	16·5	17·8				
„ length, outer margin	23	26	24	22·5	24				
„ width	15	17	16·1	15	17				
Tragus, length	7	8·8	7·8	7·2	7·8				
Lancet, length	11	12	11·3	10·8	11·5				
„ width	7	9	8·1	7	8·5				
Horseshoe, width	8·2	9	8·8	8	9·5				
Forearm	64	73·5	70·4	65	76	70·1	70·5	75	73·3
Pollex	16·5	17·8	17·1	15·5	18	16·6	14·2	17	16·4
3rd metacarpal	55·5	67·5	63·9	58·2	69	63·7	65·5	68·2	66·5
III^1	18·2	24·8	21·9	19·2	25	21·8	22	24·5	23·2
III^2	30·8	40	36·1	32·5	41	35·5	36·5	41	38·5
III^3	18	21·7	19	16·8	21·2	18·6	18	21	19·3
4th metacarpal	55	66·7	62·5	56·8	67	62·5	63	67	65·2
IV^1	17	21	18·6	17	20·8	19	18·5	21	19·7
IV^2	19	24	22·5	19·8	25·2	22·3	22·2	25	23·9
5th metacarpal	57	70	65·1	58	70	64·4	65	70	67·9
V^1	12·7	15·8	14·4	13	16	14·4	14·2	16	16·6
V^2	15	19·5	17·6	15	19·7	17·4	17·2	20	18·8
Interfemoral	18·5	21·5	20	15	20				
Lower leg	25	27·8	26·2	24·3	28	26·9	26	27	26·7
Foot, with claws	17·8	20·5	18·7	17	20	18·5	17·2	20	18·3
Calcar	7	10	8·8	7·8	10	8·5	8	10	8·9

Artibeus jamaicensis palmarum All. & Chapm.

1878. *Artibeus perspicillatus* (partim, not L.) Dobson, Cat. Chir. Brit. Mus. pp. 519–20, specimens *n*, *p*, *r*, *s*, *t*, *v*, *y*, *z*.—Venezuela, Costa Rica, Guatemala.
1893. *Artibeus perspicillatus* (not L.) Thomas, Journ. Trinidad Field Nat. Club, i. no. 7, p. 6 (April 1893).—Trinidad.
1893. *Artibeus* sp. n., J. A. Allen & Chapman, Bull. Am. Mus. N. H. v. Art. 13, p. 208 (21 Sept. 1893).—Trinidad.
1897. *Artibeus palmarum* J. A. Allen & Chapman, Bull. Am. Mus. N. H. ix. Art. 2, p. 16 (26 Feb. 1897).—Type locality: Trinidad.
1897. *Artibeus intermedius* J. A. Allen, Bull. Am. Mus. N. H. ix. Art. 3, pp. 33–34 (11 March, 1897).—Type locality: San José, Costa Rica.
1899. *Artibeus femurvillosum* Outram Bangs, Proc. New Engl. Zool. Club, i. pp. 73–74 (24 Nov. 1899).—Type locality: Santa Marta, Colombia.
1900. *Artibeus palmarum* All. & Chapm., J. A. Allen, Bull. Am. Mus. N. H. xiii. Art. 8, p. 89 (12 May, 1900).—Santa Marta, Colombia.
1901. *Artibeus palmarum* All. & Chapm., Robinson & Lyon, Proc. U.S. Nat. Mus. xxiv. pp. 148–49.—La Guaira, Venezuela (specimens examined).
1902. *Artibeus intermedius* All. (partim), Outram Bangs, Bull. Mus. Comp. Zool. xxxix. no. 2, p. 50 (April 1902).—Bogava, Chiriqui (the larger specimen recorded by the author).

Diagnosis.—Precisely similar to *A. j. lituratus*, but skull and teeth averaging slightly smaller.

General characters.—As in *A. j. lituratus* the notch in the hinder margin of m^2 is comparatively rarely (in 10 p. ct. of the skulls examined) as distinct as in *A. planirostris*, in the large majority either noticeably reduced in size or quite filled up. The skull is subject to the same modifications depending on age (text-figs. 50, 51, on p. 248). The light colour type is predominant, especially in aged individuals, but common also in adults with unworn teeth. The supraorbital stripes are as a rule, the infraorbital stripes often, well developed.

A. j. palmarum and *lituratus*.—Externally *A. j. palmarum* is indistinguishable from *A. j. lituratus*; there is no structural difference in any respect; the dimensions vary within the same limits, and even the average dimensions are practically quite the same. But there is a small average difference in the size of the skull and teeth:—the length of the skull averages 1·3 mm. (only about 4 p. ct.!) shorter, the width of the skull from 0·4 to 0·9 mm. narrower, the maxillary tooth-row 0·7 mm. shorter.

I should not have tried to keep this form separate from *A. j. lituratus*, if the name *palmarum* had not been available. The separation is artificial rather than natural; the trifling average difference pointed out above will, I believe, hold good also for much more extensive series of both forms; but it is a matter of fact that in the large majority of cases *A. j. palmarum* cannot *practically* be discriminated from *lituratus*.

A. j. lituratus and *palmarum* taken together (and as mentioned above it would be both more natural and more convenient to unite the two "forms") are distributed from S. Brazil to S. Mexico, including the coast islands of Trinidad and St. Vincent, but excluding the whole of the West Indies proper.

In Central America and S. Mexico *A. j. palmarum* meets the considerably smaller *A. j. jamaicensis*. There is no doubt what-

ever that the latter race is the truly indigenous form in the region north of Panama, and that *A. j. palmarum* is a late intruder from south into the same region. This point will be further discussed in the "General Remarks," below p. 317.

Size.—In the table of measurements p. 282, the specimens examined have been arranged in four sections, viz. individuals from (1) Venezuela, (2) Trinidad and St. Vincent Islands, (3) Central America, and (4) S. Mexico. The table shows that measurements of individuals from these four areas are identical. The four specimens from S. Mexico (Oaxaca, Vera Cruz, Jalisco) do not show the extremes of individual variation in size; hence the average measurements are not given.

Specimens examined.—47 specimens (26 skins) and 32 skulls, from the following localities:—

British Museum:—Trinidad (4).—St. Vincent Island (1).—Venezuela: Caripé (1); Tachira (1); "Venezuela" (1).—Panama: Bogava, Chiriqui, 250 m. (4).—Costa Rica: San José (3); Los Cuadros, S. Pedro (1); Costa Rica (2).—Nicaragua: Matagalpa (1).—Guatemala: Dueñas (4); Cahaban (1).—"Central America" (1).—Jalisco: Huajimic, Tepic (1).—18 skulls, from all the localities enumerated.

U.S. National Museum* :—Trinidad (1).—Venezuela: Macuto, La Guaira (12).—Costa Rica: San José (3).—Nicaragua: Escondido River, 50 miles from Bluefields (1).—Guatemala: Peten (1).—Oaxaca: Santo Domingo (2).—Vera Cruz: Mirador (1).—14 skulls, representing all these localities.

Range.—Venezuela, including Trinidad and St. Vincent Islands, through Central America, to Vera Cruz and Jalisco, Mexico.

Allen and Chapman's *A. palmarum*, 1897.—In 1893 (*l. s. c.*), Allen and Chapman recorded an "*Artibeus sp. nov.?*" (skin without skull) from Trinidad; it differed "in coloration and in the distribution of the fur on the wing-membranes from any of the currently recognised species of *Artibeus*;" forearm 63, third metacarpal 61, tibia 25·4 mm.; "color above and below light brown, much lighter on the head and anterior half of the body, the hairs nowhere tipped with gray; a broad white stripe above and a faint whitish line below each eye."

The same specimen, together with six others, also from Trinidad, formed, in 1897 (*l. s. c.*), the basis for Allen and Chapman's *A. palmarum*:—"From true *Artibeus perspicillatus*," the authors write, "the present species differs notably in colour, particularly in the presence of two prominent broad white head stripes, and two narrower and shorter whitish cheek stripes. It is also very much larger, the forearm measuring 68 mm. against 56 in true *perspicillatus*, with all the other dimensions proportionately larger. The skull is much more massive, at least one-third

* U.S. N. M. nos.:—6973 (37809), 7222, 13778, 13809 (37551), 51571, 73257–58, 101331, 102843, 102845–46, 102855–56, 102860–62, 102873–74, 102877, 102879, 103964.

larger in general bulk, and about one-sixth larger in linear measurements." Forearm of type 68, third metacarpal 64; length of skull 31, zygomatic width 19 mm.

Later on, in 1900 (*l. s. c.*), *A. palmarum* was recorded by Allen from Bonda, Santa Marta region, Colombia, and Cali, S. Colombia; in 1901 (*l. s. c.*), by Robinson and Lyon from La Guaira, Venezuela.

To understand what led Allen and Chapman to separate *A. palmarum* as a distinct species the following must be borne in mind:—Allen and Chapman identified Linné's *Vespertilio perspicillatus* (1758) with the bat later on (1822) described by Leach, on the basis of a Jamaica specimen, as *Artibeus jamaicensis* (*A. j. jamaicensis* of the present paper)*; having found that the Trinidad representative of this type of bat differed [to a certain degree] in size and colour from the Jamaica bat and, consequently, required a name of its own, they called the Trinidad form *A. palmarum*. In so far all is clear: the Trinidad bat is, in fact, as a rule distinguishable from the West Indian form. But Allen and Chapman were mistaken in their identification of Linne's *V. perspicillatus* (Seba's *V. Americanus vulgaris*), which, as pointed out by Oldfield Thomas, is not Leach's *A. jamaicensis*, but the bat commonly called *Carollia brevicauda*; further, although there is a very well-marked average difference in size and colour between Trinidad and Jamaica individuals of *A. jamaicensis*, there is absolutely no "hard-and-fast" line between them, so that they cannot be separated *specifically*; again, the Trinidad (Venezuelan, Colombian) bat comes so exceedingly near to the common Brazilian form of the species that it, for all practical purposes, is completely indistinguishable from this latter; and, last, this Brazilian form had already a name, viz. *A. j. lituratus* Licht.—The infinitesimal average difference in the size of the skull between *A. j. lituratus* and *A. j. palmarum* is the only reason (if reason it can be properly called) on the strength of which the latter can be kept separate as a "race."

J. A. Allen's *A. intermedius*, 1897.—Type locality: San José, Costa Rica. According to Allen, *A. intermedius* is "rather smaller than *A. palmarum*," "apparently intermediate between *A. palmarum* and *A. perspicillatus* [i. e. *A. j. jamaicensis*]," but "much darker, with the head stripes narrower and much less distinct, and the cheek stripes obsolete"; "brain-case narrow and high, the dorsal outline remarkably convex;" forearm 65, third metacarpal 57; length of skull 29, zygomatic width 19 mm.

A. intermedius was based on two adult and five "nearly full-grown" young individuals. If Allen had had a larger series of adults he would have found that the colour characters on which he laid stress are of no diagnostic importance; in Costa Rica, as elsewhere throughout the whole area occupied by *A. j. lituratus*

* Allen & Chapman, Bull. Am. Mus. N. H. ix. Art. i. pp. 3–5 (23 Feb. 1897).

and *palmarum*, some individuals are of the dark, others of the light colour type, some have the superciliary stripes less distinct or even obsolete, while others (and these the majority, in Costa Rica and elsewhere) have them well marked or even very strong; the infraorbital are always less pronounced than the supraorbital stripes; the colour characters given by Allen must therefore be left out of consideration when judging the validity of "*A. intermedius*."—When Allen found the type of *A. intermedius* "apparently intermediate [in size] between *A. palmarum* and *A. perspicillatus*," it is only because the specimen happens to be a small-sized individual; in the series from the type locality and adjoining regions of Central America examined by myself, there are several examples as small as (and slightly smaller than) Allen's specimen, but these represent unquestionably the *minima* of size; the other extreme is shown by the following measurements of the forearm: in two specimens from Chiriqui 70·5 and 72 mm., two from Costa Rica 71 and 73 mm., two from Nicaragua 71 and 73 mm., three from Guatemala 70, 72, and 72·5 mm.; the rest of the individuals are, of course, intermediate in size between these two extremes. Thus, also the size-character given by Allen must be dropped.—There remains the shape of the skull; but as pointed out above (p. 248, text-figs. 50, 51), this "remarkably convex" brain-case (sagittal crest produced forward, supraorbital ridges directed almost straightly outward, well developed post- and anteorbital processes) is an age character in *A. j. lituratus* and *palmarum*, not a specific character; it is by no means peculiar to Central American individuals, but occurs, to the same degree, in individuals from Paraguay, Brazil, Colombia, Venezuela, Trinidad, &c. I have carefully compared Central American (and Mexican) specimens with Trinidad and Venezuelan specimens of *A. j. palmarum*, and am unable to find any difference whatever.

In 1902 (*l. s. c.*), Outram Bangs recorded three "*A. intermedius*" from Bogava, Chiriqui, one old ♀, one youngish ♂, and one youngish ♀, and wrote:—"The younger specimens are more sooty, with the facial stripes less well indicated, and have smaller skulls .... The difference in size is great, and the skulls do not show the degree of immaturity that one would expect with the difference in size." The explanation is this: the two youngish specimens (provided they are really full-grown) were, no doubt, *A. j. jamaicensis*, the old female an *A. j. palmarum*. It cannot be too strongly emphasised that Central America and S. Mexico are inhabited by two forms of *A. jamaicensis*—the one, and small, is the truly indigenous race, *A. j. jamaicensis*, occurring also in Jamaica, San Domingo, Porto Rico, eastwards at least to St. Kitts; the other, and larger, is *A. j. palmarum* (or, if preferred, *A. j. lituratus*), which has come from south,—two forms which till now have been mixed together. As the two races are not perfectly differentiated "species," one cannot expect them to be separable in all particular instances; but many individuals can be identified at a glance, and whenever the external characters

leave the identification unsettled, a careful examination of the skull and teeth will, with rare exceptions, decide the matter. It is a case parallel to that of *Hipposiderus caffer caffer* and *H. c. centralis* in British and German East Africa * ; two very well marked modifications of one common type, differing in size only, and originally, no doubt, occupying quite separate areas, but the latter has in the course of time spread over a part of the region of the former, as has *A. j. palmarum* over that of *A. j. jamaicensis*; in the one instance as in the other the races are, however, on careful examination almost always separable, even when found together on the same spot.

Outram Bangs's *A. femurvillosum*, 1899.—Type locality: La

Measurements of Artibeus jamaicensis palmarum.

	Venezuela (Macuto, Caripé, Tachira). 15 adults, 10 skulls.			Trinidad, St. Vincent Island. 4 adults, 3 skulls.		Central America (Panama, Costa Rica, Nicaragua, Guatemala). 20 adults, 15 skulls.			Mexico (Vera Cruz, Jalisco, Oaxaca). 4 adults, 3 skulls.	
	Min.	Max.	Med.	Min.	Max.	Min.	Max.	Med.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length, to front of c	30	32	31	...	31	29·7	31·8	30·6	30	30·7
„ mastoid width	16·2	17·5	17	...	16·2	15·8	17·6	16·8	16·2	17
„ width of brain-case	13	14	14	...	13·8	13·6	14·5	14	13·8	14
„ zygomatic width	17·1	20·3	18·9	...	20	18	20	18·9	18·8	19·2
„ maxillary width across m^1	13	14	13·4	14	14·6	13	14	13·5	13·2	13·8
„ across cingula of canines	8·5	9	8·9	8·1	9	8·2	9·1	8·7	8·2	9
Mandible, to front of inc.	20·8	22·5	21·5	...	22·2	20	22·6	21·4	20·7	21·2
Upper teeth, c–m^2	10·5	11·8	11·2	11	11·8	10·2	11·2	10·9	10·3	11·7
Lower teeth, c–m_3	11·6	12·7	12·2	12	12·8	11·7	12·7	12·2	11·2	11·5
Ear-conch, length, inner margin	16	17·7	16·6	16	18	15·5	17·3	16·7	...	16·5
„ length, outer margin	21	24·5	23·2	23	25	21	26	23·6	...	24·5
„ width	15	16·3	15·5	16	16·5	15·2	17·7	16	...	17
Tragus, length	7·8	8·5	8	7	8·5	7·7	8	7·9	...	7
Lancet, length	9·8	12	11	10	11·7	10	11·5	10·7	...	11·2
„ width	7	8·8	7·9	7·5	8·5	7	8·8	7·9	...	8·2
Horseshoe, width	8·2	9·8	8·9	8·8	9·2	8·3	9·8	8·9		
Forearm	68·2	75·8	71	67·5	72·5	64	75	70·6	68	71
Pollex	15	17·7	17·1	15·2	17·5	15	16·8	16·1	15·7	15·7
3rd metacarpal	61·7	68·5	64·6	60	68	58·8	66·5	63·8	58·5	63
III^1	21	24·8	22·8	19·2	23·2	20	24	22·4	20	22·2
III^2	31	39·8	36·4	33	38·2	33	39	36·7	33·7	35·8
III^3	16·8	20·2	18·2	17·7	21	17·2	20·8	18·7	17	18·7
4th metacarpal	59·7	66·5	63·3	58·5	66	58	66·2	62·6	58	61·5
IV^1	17·8	21	19·1	17·5	19·2	17·2	21·5	19	17·5	18·8
IV^2	20	24·2	22·5	20·8	24	21	25·8	23·3	20·8	23
5th metacarpal	61·7	69	65·8	61·8	68·5	59·5	67·3	64·5	59·2	65
V^1	12·8	16	14·8	12·8	16	14·2	17	14·7	14	14·8
V^2	15·2	19·8	17·8	14·7	19·2	16·8	20	18·3	16	18
Interfemoral	17·5	21	19·2	17	18	17	22	19·6	15	
Lower leg	24	27	25·5	25	27·5	24	26·8	25·6	22·8	24·5
Foot, with claws	17	19·8	18·4	17·8	19	16·5	20	18	16·2	17·8
Calcar	7·7	10·2	9·1	7·5	9·7	7·2	9	8·6	7·2	

* Knud Andersen, Ann. & Mag. N. H. (7) xvii. p. 281; March 1906.

Concepcion, Sierra Nevada de Santa Marta, Colombia, 3000 feet. —The essential points in the original description are these:— "About the size of *A. palmarum*, differing from that species in having but one pair of face stripes (no cheek stripes) .... these stripes narrow and not very conspicuous. The new species differs from all others of the genus I have seen in having the upper surfaces of legs, feet, and interfemoral membrane clothed with short fur. In the allied species these parts are naked." Length of forearm, metacarpals and phalanges not given by the author; it is unnecessary to quote the measurements of the skulls, as they are precisely as in many *A. j. palmarum*.—*A. femurvillosum* was half a year later (1900, *l. s. c.*) put down by Allen as a synonym of "*A. palmarum*."

The colour characters given by Bangs need no comment; they are valueless for diagnostic purposes. The statement that the upper surfaces of the legs, feet, and interfemoral are naked in "the allied species," is a mistake; in all the specimens I have seen of *A. jamaicensis*, of any race, they are hairy. Thus nothing is left by which *A. femurvillosum* can be discriminated from *A. j. palmarum*.

Artibeus jamaicensis præceps K. And.

1906. *Artibeus jamaicensis præceps* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 421 (1 Dec. 1906).—Type locality: Guadeloupe, W. I.

Diagnosis.—Similar to *A. j. palmarum*, but forearm and hand averaging shorter.

A. j. præceps and *palmarum*.—Individuals of *A. jamaicensis* from Trinidad and St. Vincent Island are indistinguishable from the continental *A. j. palmarum* (or, if this form is not recognised, from *A. j. lituratus*). From the Windward Islands between St. Vincent and Dominica I have had no specimens.—In Dominica and Guadeloupe *A. j. palmarum* is replaced by the slightly differing *A. j. præceps*. Three skulls of this race are practically almost indistinguishable from the ordinary *palmarum* skull; they show a tendency to go slighty below the minimum size in the large number of *palmarum* skulls examined, so that there can scarcely be any doubt that, in a more extensive series, skulls of *præceps* will prove to average a little more slenderly built. The teeth will probably also average slightly smaller. There is a similar indication of a decrease in the external dimensions, especially noticeable in the length of the forearm and hand: in the three adult examples of *A. j. præceps* the forearm measures 60, 65·5, and 66·2 mm., in 43 adult examples of *A. j. palmarum* the average length of the forearm is 70·9 mm., and none has the forearm less than 64 mm.; of the whole series of *palmarum* two only (5 p. ct.) have the forearm less than 66·5 mm., whereas in all examples of *præceps* available the forearm falls short of that length; for further details (metacarpals, proximal phalanges, tibiæ) see table of measurements below, p. 284.—From the

Summary of measurements of the Geographical Races of Artibeus jamaicensis.

	parvipes.	*yucatanicus.*	*jamaicensis.*	*æquatorialis.*	*lituratus.*	*palmarum.*	*præceps.*	
	25 adults, 12 skulls.	14 adults, 12 skulls.	95 adults, 65 skulls.	7 adults, 6 skulls.	41 adults, 33 skulls.	43 adults, 31 skulls.	3 adults, 3 skulls.	
	AVERAGE.	AVERAGE.	AVERAGE.	AVERAGE.	AVERAGE.	AVERAGE.	MIN.	MAX.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to front of c	26·9	27·4	28·3	29·7	32·1	30·8	14·5	16·2
„ mastoid width	14·4	14·6	15·1	15·8	17·2	16·8	15	16
„ width of brain-case	12·1	12·3	12·7	13·1	14·1	14	12·7	13·2
„ zygomatic width	16·1	16·8	17·4	18·3	19·4	18·9	17·8	18·2
„ maxillary width across m^1	11·8	12·1	12·6	13·6	14·4	13·5	13·2	13·6
„ across cingula of canines	7·5	7·7	8·1	8·9	9·2	8·8	8·6	8·7
Mandible, to front of inc.	18·4	18·9	19·5	21·1	22·6	21·5	20·4	20·8
Upper teeth, c–m^2	9·7	9·9	10·3	11	11·7	11	10·8	10·8
Lower teeth, c–m_3	10·4	10·7	11·1	12·1	12·8	12·2	11·6	11·7
Ear-conch, length, inner margin	14·4	.....	14·8	.....	17·2	16·7	14·5	16·2
„ length, outer margin	20·3	.....	21·4	.....	24	23·4	20	22
„ width	14·2	.....	21·3	.....	16	15·8	15	16
Tragus, length	6·8	.....	7	.....	7·8	7·9	7·5	
Lancet, length	9·3	.....	9·6	.....	11·3	10·8	10	11
„ width	6·4	.....	6·8	.....	8	7·9	7	7·2
Horseshoe, width	7·3	.....	7·6	.....	8·8	8·9	8·2	
Forearm	56·8	59·6	60·1	62·9	70·2	70·9	60	66·2
Pollex	13·9	13·7	14·2	14·4	16·8	16·5	15·5	16·5
3rd metacarpal	51·3	53·8	53·7	56·9	63·8	64·2	54·8	61
III^1	16·3	17·2	17·3	18·4	21·8	22·5	18	19
III^2	27·3	28·8	28·8	30·9	35·7	36·5	30·2	34
III^3	14·5	14·6	15·5	16·9	18·8	18·5	16·2	17·8
4th metacarpal	50·2	53	52·9	55·4	62·5	62·9	54	60
IV^1	14·5	15·3	15·2	16·6	18·9	19	16·2	16·8
IV^2	17·9	19	19	19·9	22·4	22·9	19·7	22
5th metacarpal	51·9	54·5	54·7	57·2	64·7	65·1	55·5	61·5
V^1	11·3	11·7	11·9	12·8	14·4	14·8	11·8	12·8
V^2	13·6	14·6	14·5	15·4	17·5	18	14·8	16·8
Interfemoral	14·1	.....	15·5	.....	19·3	19·3	14·5	20·5
Lower leg	21·6	22·2	22·8	24·1	26·6	25·6	23	25
Foot, with claws	15·4	15·7	16·1	16·8	18·6	18·2	17	18·2
Calcar	6·4	.....	6·5	7·2	8·6	8·8	6	6·7

islands between Guadeloupe and St. Kitts no specimens have been available. St. Kitts is inhabited by *A. j. jamaicensis*, the range of which, so far as the West Indies are concerned, extends from here westwards over Porto Rico and San Domingo to Jamaica.

A. j. præceps comes in every respect considerably nearer to its southern neighbour, *A. j. palmarum*, than to its western neighbour, *A. j. jamaicensis*. From this it seems reasonable to conclude that it is a northern offshoot of *A. j. palmarum*, not an eastern offshoot of *A. j. jamaicensis*.

It would be practically impossible to discriminate *A. j. præceps* from *A. j. æquatorialis*; but the latter is a large southern representative of *A. j. jamaicensis* inhabiting Ecuador and S. Colombia, the former a slightly diminished insular representative of *A. j. palmarum*, inhabiting, as just pointed out, certain islands between St. Vincent and St. Kitts. Their extremely close resemblance is a coincidence; the descent of the two races is different, and they occupy widely separated areas; they have acquired similar features, but by different lines of development.

Specimens examined.—Dominica (1), Guadeloupe (2). With skulls. From the collection of the U.S. National Museum *.

Range.—As yet known only from Dominica and Guadeloupe, W. I.

Artibeus glaucus Thos.

1844. ? *Phyllostoma pusillum* (not Natterer) Tschudi, Fauna Peruana, pp. 63–64.
1893. *Artibeus glaucus* Thomas, P. Z. S. 1893 (18 April) pp. 336–37, pl. xxix. figs. 7–9.—Type locality: Chanchamayo, Peru.

Diagnosis.—Molars $\frac{2}{3}$. Cusp 7 of m^1 small. Forearm 43·8 mm.

Skull.—In shape the skull is almost precisely similar to that of *A. hirsutus*, *planirostris*, or *jamaicensis*, the only appreciable difference being the slightly lower brain-case; but it is much smaller: in linear dimensions $\frac{3}{4}$, in bulk less than $\frac{1}{2}$, the size of an *A. hirsutus* skull.

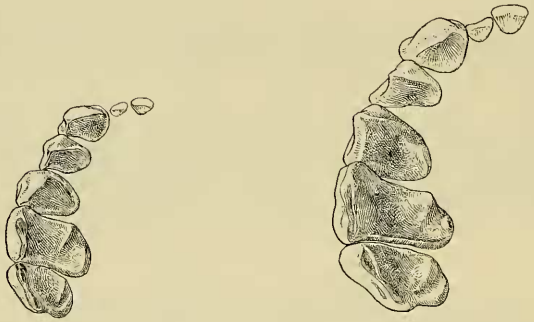
Teeth.—Differ from those of *A. concolor*, *planirostris*, and *hirsutus*, and accord with those of *A. jamaicensis*, in the complete disappearance of m^3; differ from those of all the species mentioned chiefly in the less developed lingual parts of the premolars and molars (particularly of m^1), and in the much smaller size of all the teeth.

The inner heels of p^3 and p^4 are proportionately slightly smaller than in the foregoing species. In all of these latter there is a small, but perfectly distinct, cusp rising from the antero-internal margin of the heel of p^4; in *glaucus* this cusp is practically wanting (an exceedingly faint indication of the cusp is detectable by the aid of a strong lens). *Cusp 7 of* m^1 (the postero-internally projecting portion of the tooth) *is considerably less developed* than in any of the foregoing species; in the single skull available it is not much more than a distinctly projecting

* U.S. N. M. nos. 113503–4, 113628.

ledge, whereas in *jamaicensis* (and in *concolor*, *planirostris*, and *hirsutus*) it is equal to from one-third to one-fifth the area of the tooth. The angular emargination in the posterior border of m^2 (into which m^3 is pressed in those species which possess this rudimentary tooth, and which, as pointed out above, pp. 250–252, is very often preserved in *A. jamaicensis*, although this species has lost m^3) is in *glaucus* but faintly indicated, the whole postero-internal portion of m^2 being formed by the slightly projecting cusp 7.—The lower teeth do not differ in structure from those of the foregoing species; the small m_3 is still more reduced in size.

Text-fig. 53.



A. *Artibeus glaucus*, ♀ ad. Chanchamayo, Peru. Type, B.M. 94.8.6.13. Right upper tooth-row. × 4/1.

B. *Artibeus jamaicensis jamaicensis*, ♂ yg. ad. Jamaica. B.M. 7.1.1.677. Right upper tooth-row. × 4/1.

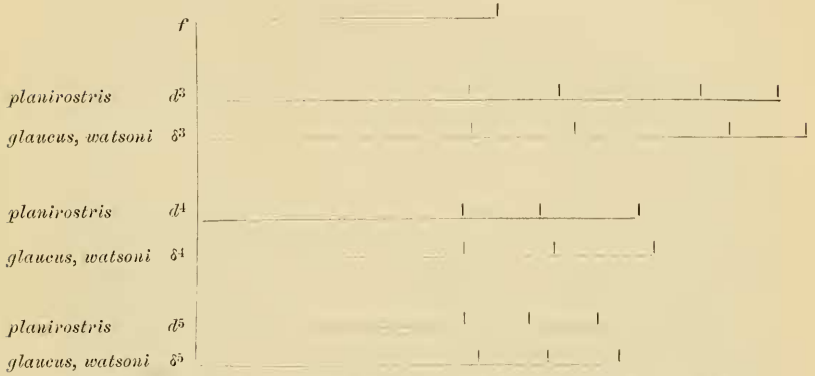
Nose-leaves.—Front margin of horseshoe free, simple.

Tragus.—Two indistinct serrations on the outer margin above the median projection; in a larger series some individual variation will be found in this respect.

Wings.—The third, fourth, and fifth digits are proportionately longer than in the *planirostris* and *jamaicensis* sections; in *planirostris* the indices of these digits (including the metacarpals, but excluding the terminal cartilaginous rods of the distal phalanges) are, respectively, 1945, 1477, and 1346; in *glaucus* and *watsoni* (which are similar in the wing-structure as in almost all other respects), 2025, 1497, and 1405; as proved by these figures, particularly the third and fifth digits are lengthened *, to a less degree the fourth. A

* "Lengthened" means here simply longer as compared with the digits of bats of the *planirostris* and *jamaicensis* type; it does not imply that the writer is of opinion that the wing-structure of *glaucus* and *watsoni* can, phylogenetically, be derived from that of the *planirostris-jamaicensis* type. We have no means to determine, with any degree of probability, which of these wing-structures is the more primitive, *i. e.* comes nearest to that of the prototype of the genus.

closer examination shows that not all parts of the digits have been lengthened in *glaucus* and *watsoni*; the metacarpals are practically quite as in *planirostris* and *jamaicensis* (the fifth metacarpal very slightly lengthened), but the first and second phalanx of the third digit, and the first phalanx of the fourth and fifth digits are noticeably longer. The wing-indices on p. 310, and the diagram below show the details. One fact resulting from this modification is worth noticing: both the first and the second phalanx of the third digit are lengthened, but the former considerably more than the latter (lengthening of first phalanx 57, of second only 27 mm., for an assumed length of forearm of 1000 mm.). The result is that, whereas in the *planirostris* and *jamaicensis* type the second phalanx of the third digit is very distinctly more than $1\frac{1}{2}$ the length of the first, it is in *glaucus* and *watsoni* always less than $1\frac{1}{2}$ of the first, a peculiarity easily ascertained on careful examination of the wings of these bats.



f, forearm. Given this length of the forearm, the third, fourth, and fifth digits have in *A. planirostris* the lengths indicated by the lines d^3, d^4, and d^5, in *A. glaucus* and *watsoni* the lengths indicated by the lines δ^3, δ^4, and δ^5. The subdivisions of d^3 and δ^3, in direction from left to right, indicate the metacarpal, first, second, and third phalanx; those of d^4, δ^4, and d^5, δ^5 the metacarpal, first and second phalanx.

Hairing on limbs and membranes.—Above, the proximal two thirds of the forearm densely haired; a tuft of hairs on the metacarpal of the pollex; the interfemoral, femur, tibia, and foot to the claws, covered with very short sparse hairs. Below, the interfemoral hairy along the middle, almost naked laterally.

Colour.—The fur of the only specimen on record, a young adult female (full-grown, but epiphyses of metacarpals separate) preserved in alcohol, has the following colour:—Upper side greyish drab with a slight tinge of fawn, base of hairs lighter, washed with ecru-drab. Under side light greyish drab. White supraorbital and infraorbital stripes distinct. Apparently no white margins to the ears.

Measurements.—On p. 289.

Specimens examined.—One, the type, in the collection of the British Museum.

Range.—Chanchamayo, Junin, Central Peru.

Tschudi's *Phyllostoma pusillum*, 1844.—Indeterminable from the description; the author refers only to the colour, the nose-leaves, ears, membranes, and general size; neither to the skull nor to the teeth. The only measurement of any practical value is that of the forearm, " 1″ 5‴ " (*i. e.* 37 mm.); if this measurement was taken according to the same method as used in the present paper, and if the specimen measured was full-grown, then Tschudi's bat was not an *A. glaucus*; if an *Artibeus* (not a *Vampyrops*), it may have been *A. rosenbergi*.—Even if Tschudi's *Ph. pusillum* were proved to be *A. glaucus*, the latter name would have to stand, the former being preoccupied by Natterer's *Ph. pusillum*, which is *Vampyressa pusilla**.

Artibeus watsoni Thos.

1901. *Artibeus watsoni* Thomas, Ann. & Mag. N. H. (7) vii. pp. 542–43 (1 June, 1901).—Type locality; Bogava, Chiriqui.

1804. *Artibeus watsoni* Thos., J. A. Allen, Bull. Am. Mus. N. H. xx. Art. iv. p. 79 (29 Feb. 1904).—Boqueron, Chiriqui.

Diagnosis.—Similar to *A. glaucus*, but smaller. Forearm 37·2–40·5.

A. watsoni and *glaucus*.—*A. watsoni* is a Central American representative of the *A. glaucus* type, differing from the Peruvian species only in the rather smaller size, proportionately slightly longer ears, and longer interfemoral.

The skull is quite of the same shape as in *glaucus*, but a trifle smaller, especially narrower; of nine skulls of *watsoni* none reaches the single skull of *glaucus* in size.

The teeth are in every respect (including the size) as in *glaucus*. There is, as a rule, a faint remnant of the notch in the hinder margin of m^2, between its cusps 5 and 7, but in some individuals also this trace has disappeared, the margin being perfectly simple.

The horseshoe is free all round, the margin sometimes simple, sometimes finely crenulate.

The ears are, apparently, proportionately a little longer, and rather narrower in their upper half (less broadly rounded off) than in *glaucus*; but of nine specimens examined of *watsoni* two only are preserved in alcohol, and only one specimen of *glaucus* is available for comparison. Three small serrations on the outer margin of the tragus above the median projection.

Both the alcoholic specimens have the interfemoral markedly longer than in *A. glaucus*: 11·8 and 13·5 mm., as against 8 mm.

On the wing-structure, see *A. glaucus* (above, p. 287). Hairing on limbs and membranes as in *A. glaucus*.

* Thomas, Ann. & Mag. N. H. (6) iv. pp. 169–70 (Aug. 1889); and (7) v. p. 270 (March 1900).

Measurements of Artibeus glaucus *and* watsoni.

	A. glaucus.	*A. watsoni.*		
	♀ yg. ad. Type.	9 adults, 9 skulls.		
		Min.	Max.	Med.
	mm.	mm.	mm.	mm.
Skull, total length to front of c ...	21·2	18·7	20·8	19·7
„ mastoid width ...	11	9·8	10·8	10·1
„ width of brain-case ...	9·5	8·7	8·8	8·7
„ zygomatic width ...	12	11·2	11·8	11·6
„ maxillary width across m^1 ...	8·8	8·2	8·6	8·4
„ across cingula of canines ...	5·8	5·5	6	5·7
Mandible, to front of inc. ...	14	12·5	13·9	13·1
Upper teeth, c–m^2 ...	6·8	6·5	7	6·7
Lower teeth, c–m_3 ...	7·2	6·8	7·5	7·1
Ear-conch, length, inner margin ...	10·5	11	12	
„ length, outer margin ...	14	15	16·2	
„ width ...	12	12	12·2	
Tragus, length ...	4·8	5·5	6·2	
Lancet, length ...	9·2	8·5	9	
„ width ...	5	5·2	6·2	
Horseshoe, width ...	6·5	6·3	7	
Forearm ...	43·8	37·2	40·5	39
Pollex ...	11	9·5	11	10·2
3rd metacarpal ...	39·4	33·7	36·2	35·3
III^1 ...	15·8	13	15	13·9
III^2 ...	23	18·7	21	20
III^3 ...	12·8	8·8	11·2	10·2
4th metacarpal ...	39	33·2	36·2	34·7
IV^1 ...	13	11	12·2	11·6
IV^2 ...	15	11	13·5	12·3
5th metacarpal ...	41	33·8	37·5	36·1
V^1 ...	11	8	9·5	8·7
V^2 ...	12	9	11·2	10·2
Interfemoral ...	8	11·8	13·5	
Lower leg ...	14·5	12·8	14·7	13·7
Foot, with claws ...	10·3	9·2	10	9·7
Calcar ...	4·5	4·2	5·2	4·7

Colour.—Of six skins, four are dark, two lighter coloured.

Darker stage; 4 skins, Bogava (Chiriqui) and Cebaco I.; full-grown, teeth unworn or slightly worn, epiphyses of metacarpals separate in one, ossified in the others:—Upper side from the shoulders backward sepia-brown (browner than Ridgway's "sepia"), this colour confined to the narrow tips of the hairs; base of hairs drab. Front part of upper side, from the shoulders forward, of a rather lighter shade, more drabbish brown, owing to the darker hair-tips being extremely short or wanting; base of hairs approaching ecru-drab; there is no contrast between the hinder and anterior part of the back, the colour of the former shading gradually into that of the latter. Under side dark grey. White supra- and infraorbital stripes strongly pronounced. Ear-conch very narrowly margined with white. Tip of the third digit and adjoining membrane not lighter-coloured.—The four specimens are almost alike in the shade of the colour.

Lighter stage; 2 skins, Bogava (Chiriqui) and Sevilla I.; full-grown, teeth unworn, epiphyses of metacarpals ossified.—Upper side wood-brown, washed with a slightly darker shade on the hinder back; base of hairs ecru-drab on the hinder back, whitish washed with ecru-drab in front of the shoulders. Under side lighter wood-brown. Facial stripes strong. Narrow white edgings to the ears. No light-coloured tips to the wings.—The two specimens are almost alike in colour, rather strongly contrasting with the four described above.

Measurements.—On p. 289.

Specimens examined.—9 specimens (two in alcohol, one skin in alcohol, six dried skins) with skulls, from the following localities:—

British Museum:—Bogava, Chiriqui, Panama (5); Cebaco I., Panama (2); Sevilla I., Panama (1).

U.S. National Museum*:—Escondido River, Nicaragua (1).

Range.—Central America (Panama, Nicaragua).

Artibeus cinereus Gervais.

Diagnosis.—Molars $\frac{2}{2}$. Cusp 7 of m^1 relatively small. m^2 equal to about $\frac{2}{3}$ or $\frac{3}{4}$ the area of m^1. Forearm 39–44 mm.

Skull.—Not differing in shape from that of *A. glaucus* and *watsoni*; also the linear dimensions are, in every respect, very nearly the same as in those species.

Teeth (text-fig. 54).—The teeth bear still more decisive evidence of the very close relationship between *A. cinereus* and *A. glaucus* and *watsoni*. As in these latter, *cusp 7 of m^1 is relatively small*,

Text-fig. 54.

Artibeus cinereus cinereus, ♂ ad. Para. B.M. 1.7.19.3.
Right upper tooth-row (note small cusp 7 of m^1). × $\frac{4}{1}$.

equal to from one ninth to one seventh the bulk of the whole tooth; at least on average it is, no doubt, a trifle more developed than in *glaucus* and *watsoni*, but not nearly as in *toltecus* and *aztecus*.—The teeth differ only in the following points, of minor importance:—

m_3 (rudimentary in *glaucus* and *watsoni*) has completely disappeared; 16 skulls, representing both of the races of *A. cinereus*

* U.S. N. M. no. 51544.

recognised in this paper, have been examined, in none of them is m_3, or any trace of its alveolus, present.—The heel of p^4 is a trifle larger than in *glaucus* and *watsoni*, but the difference is so small as only to be ascertained on very close comparison of the teeth. The small increase in the size of the heel of p^4 corresponds to the small increase (on average) mentioned above in the size of the "heel" (cusp 7) of m^1.

As in *glaucus* and *watsoni* there is only a very faint trace (or, often, no indication at all) of a notch in the hinder margin of m^2, between its cusps 5 and 7.

Tragus.—2, 3, or 4 serrations on the outer margin above the median projection, always small, sometimes rather sharply defined, sometimes so obsolete that their number cannot be counted with certainty.

Nose-leaves.—The margin of the horseshoe is free all round, simple or finely crenulate.

Wings.—The peculiarities in the wing-structure described above in *A. glaucus* and *watsoni* (p. 287) are also found in their closest relative *A. cinereus*; as in the former species the second phalanx of the third digit is not fully $1\frac{1}{2}$ the length of the first. The only appreciable difference is a slight lengthening of the metacarpals and of the phalanges of the fourth and fifth digits; by this modification the wings have become on the whole slightly longer and, because the increase falls chiefly on the fourth and fifth digits, somewhat broader than in *glaucus* and *watsoni*. See the wing-indices, below p. 310.

Hairing on limbs and membranes.—As in *A. glaucus* and *watsoni* (above p. 287).

Colour.—There is no difference in colour between the two geographical races of *A. cinereus*. The only skin available of a young (not full-grown) individual is very dark-coloured, almost precisely as young individuals of *A. jamaicensis*. Some of the adult specimens with unworn teeth come extremely near in colour to this young one, while the majority are a shade lighter, being quite indistinguishable in colour from *A. watsoni*; a few specimens are washed with drab-brown on the upper side; none are as light as the light-coloured stage of *A. watsoni* described above (p. 290).

Young, nearly full-grown (San Julian, Venezuela; U.S. N. M. 105432; *A. c. bogotensis*):—Upper side from the shoulders backward dark smoky brown, almost blackish brown, this colour confined to the tips of the hairs; base of hairs slate. On the anterior part of the upper side, from the shoulder region forward, the hair-bases are considerably lighter, nearly smoke-grey. Under side dark grey, approaching hair-brown. White supraorbital and infraorbital stripes strong. Ear-conch narrowly margined with white. No light tips to the wings.

A majority of adult individuals, teeth unworn or worn (both races):—Precisely as the darker stage of *A. watsoni* (p. 289).

Two adults (Kanuku Mts., Guiana; and Merida, Venezuela; teeth unworn; *A. c. cinereus*):—Upper side washed with drab-

brown; hair-bases on the hinder back light greyish drab, on the neck ecru-drab. Under side drab. Facial stripes strong. Narrow white edgings to the ears. No light tips to the wings.—These are the lightest coloured individuals I have seen; very likely a still lighter phase occurs, similar to that of *A. watsoni* (p. 290).

Range.—Northern part of S. America: Para, Guiana, Venezuela (including Trinidad), Colombia.

Remarks.—This species cannot be discriminated with certainty from *A. glaucus* and *watsoni* without an examination of the teeth (a rudimentary m_3 present in *glaucus* and *watsoni*, wanting in *cinereus*).

Two geographical races are separable, differing only in size. The one, *A. c. cinereus*, has probably its centre of distribution in Guiana, having spread southward at least to Para, northward to N.W. Venezuela; the other, *A. c. bogotensis*, seems to have its centre in Colombia, having spread northward to N.W. Venezuela, where consequently both forms meet.

Artibeus cinereus cinereus Gervais.

Stenoderma cinereum Blainville, MS. label in Paris Museum (*fide* Gervais, *l. i. c.*).

1856. *Dermanura cinereum* Gervais, Exp. Castelnau, Mamm. 2e Mém. livr. 15, sheet 5*, p. 36; pl. viii. figs. 4, 4*a*; pl. ix. figs. 4, 4*a*; pl. xi. fig. 3.—Type locality: "Brésil."

1901. *Artibeus cinereus* Gerv., Thomas, Ann. & Mag. N. H. (7) viii. p. 143 (Aug. 1901).—Kanuku Mts.

1901. *Artibeus cinereus* Gerv., Thomas, Ann. & Mus. N. H. (7) viii. p. 192 (Sept. 1901).—Para.

Diagnosis.—Teeth, skull, and external dimensions averaging smaller. Forearm 39–42 mm.

A. c. cinereus and *bogotensis.*—There is only an average difference between the eastern form of *A. cinereus* here under consideration and the western form of the same species described below (*A. c. bogotensis*). The skull, in *A. c. cinereus*, is on the whole slightly narrower, the maxillary width ranging between 8 and 8·6 mm. (average 8·3 mm.), in *A. c. bogotensis* between 8·5 and 8·9 mm. (average 8·6 mm.). The teeth are slightly smaller; the length of the upper tooth-row varies between 6·4 and 6·8 mm. (average 6·7 mm.), in *A. c. bogotensis* between 6·7 and 7·2 mm. (average 6·9 mm.). The forearm and metacarpals average 2·2–3·5 mm. shorter.

Measurements.—On p. 295.

Specimens examined.—10 specimens (4 skins) and 8 skulls, from the following localities:—

British Museum:—Para (1). Kanuku Mts., British Guiana, about 59° W., 3° N. (4). Trinidad (1). Merida, Venezuela (2). N.W. Venezuela (1).—7 skulls, representing all these localities.

* The title-page of the volume is dated 1855; on the probable dates of publication of the livraisons see C. Davies Sherborn and B. B. Woodward, Ann. & Mag. N. H. (7) viii. p. 164 (Aug. 1901).

U.S. National Museum* :—Merida, Venezuela (1), with skull.

Range.—Guiana, southward at least to Para, northward to N.W. Venezuela, including the island of Trinidad.—In N.W. Venezuela it meets *A. c. bogotensis*; in this region the two races apparently merge into one another.

Gervais's *Artibeus cinereus*, 1856.—Type locality: Brazil.—Notwithstanding the rather defective description there cannot be much doubt as to the identification of Gervais's specimen; it is a small *Artibeus* with $\frac{2}{2}$ molars, a small cusp 7 of m^1 (see Pl. ix. fig. 4), and the locality is, as mentioned, "Brésil." The combination of the habitat and the two characters quoted exclude all other known species of the genus. The coloured figure on Pl. ix., stated to be of natural size, is about 16 p. ct. too large in linear dimensions (compare the measurements of the forearm and tibia as given by Gervais); the metacarpals and phalanges are very carelessly drawn.

Artibeus cinereus bogotensis K. And.

1880. ? "*Artibeus quadrivittatus* Pet.," Dobson, P. Z. S. p. 465.—Popayan, N. Colombia (Paris Museum; specimen not examined).

1901. *Dermanura quadrivittatum* (not Peters) Robinson & Lyon, Proc. U.S. Nat. Mus. xxiv. (no. 1246) p. 510.—San Julian, Venezuela (only specimens W.R. 1586 and 1617 examined).

1906. *Artibeus cinereus bogotensis* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 421 (Dec. 1906).—Type locality: Curiche, nr. Bogota, Colombia.

Diagnosis.—Similar to *A. c. cinereus*, but teeth, skull, and external dimensions averaging larger. Forearm 41·2–44 mm.

A. c. bogotensis and *cinereus.*—The differences between this form and its eastern representative, *A. c. cinereus*, have been pointed out above, p. 292.

Measurements.—On p. 295.

Specimens examined.—9 specimens (8 skins) with skulls, from the following localities:—

British Museum:—Colombia: Bogota region, various localities (5). N.W. Venezuela (1).

U.S. National Museum†:—San Julian, 8 miles east of La Guaira, Venezuela (2). Merida, Venezuela (1).

Range.—From Central Colombia to N.W. Venezuela, where it meets *A. c. cinereus.* In the latter region the two races apparently merge into one another.

Artibeus rosenbergi Thos.

1897. *Artibeus* (*Dermanura?*) *rosenbergi* Thomas, Ann. & Mag. N. H. (6) xx. pp. 545–46 (Dec. 1897).—Type locality: Cachavi, N. Ecuador.

Diagnosis.—Molars $\frac{2}{2}$. Cusp 7 of m^1 small, m^2 equal to about $\frac{1}{3}$ the area of m^1. Forearm 37·8–39·8 mm.

Skull.—Very similar in shape to that of *A. watsoni* and *A. cinereus cinereus.*

Teeth (text-fig. 55).—Different from those of any other species of

* U.S. N. M. no. 123348.

† U.S. N. M. nos. 105432–33 (nos. W.R. 1586 and 1617), 123344.

Artibeus, chiefly in the strong reduction in the size of m^2. m^1 not essentially different from that of *A. watsoni*; cusp 7, if anything, still less developed, represented only by a narrow, slightly projecting shelf, therefore as narrow as in any *Vampyrops*, its basal outline almost perfectly quadrate. m^2 little more than $\frac{1}{3}$ (in all other species of the genus $\frac{2}{3}$ or $\frac{3}{4}$) the area of m^1, but all the elements of the tooth (cusps 4, 5, 6, 7) are distinct, and all of them have been very nearly equally reduced in size, though perhaps cusp 7 a little more than the others.

Text-fig. 55.

Artibeus rosenbergi, ♂ ad. Cachavi, N. Ecuador. Type, B.M. 97.11.7.76. Right upper (A), left lower tooth-row (B). × $\frac{4}{1}$.
On m_3 in this species see text below.

The lower m_2 is proportionally a little smaller than usual in the genus, but by no means reduced to the same degree as m^2; the area of m_2 is about $\frac{2}{3}$ (in other species about $\frac{3}{4}$) that of m_1. In the type specimen of *A. rosenbergi* an excessively small m_3 is present on the left side, entirely wanting on the right side; the normal condition is no doubt that m_3 is wanting. In the material sent for identification from the U.S. National Museum I find a second specimen of *A. rosenbergi* (no. 62635), in which there is no trace of m_3; and in *A. toltecus*, which has $\frac{2}{2}$ molars, one skull, out of 27, has an m_3 on one side of the mandible, thus showing an individual anomaly apparently perfectly like that of the type skull of *A. rosenbergi*.

Tragus and horseshoe.—The tragus has one or two serrations on the outer margin above the median projection. The horseshoe is free all round, the margin simple or finely crenulate.

Wings.—The most noteworthy peculiarity in the wing-structure is a conspicuous lengthening of the metacarpals; the phalanges are very nearly of the same relative length as in *A. glaucus* and *watsoni*, the first phalanx of the third digit perhaps not quite as long as in those species. See the wing-indices, p. 310.

Hairing on limbs and membranes.—Essentially as in the nearest relatives, *A. glaucus*, *watsoni*, and *cinereus*. Above, the proximal half of the forearm densely haired; a tuft of short hairs on first metacarpal; femur, tibia, foot to the claws, and interfemoral

to its posterior margin covered with rather short and sparse hairs. Below, the hairing on the interfemoral chiefly confined to its median portion and posterior margin.

Colour (of the type specimen, an adult male with slightly worn teeth, preserved in alcohol):—Brownish drab above, base of hairs much lighter; under side greyish drab. White facial stripes strong. No white margins to the ears, no white tips to the wings.

Measurements.—See table below.

Specimens examined.—Two specimens (in alcohol) with skulls, viz., one from Cachavi, N. Ecuador (British Museum, the type), and one from La Guaira, Venezuela (U.S. National Museum *).

Measurements of Artibeus cinereus *and* rosenbergi.

	A. cinereus.						*A. rosenbergi.*	
	cinereus.			*bogotensis.*				
	10 adults, 8 skulls.			8 adults, 8 skulls.			2 adults, 2 skulls.	
	Min.	Max.	Med.	Min.	Max.	Med.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to front of c ...	19·8	21	20·3	20·2	21	20·8	20·7	
„ mastoid width ...	10	10·5	10·3	10·8	11	10·9	10·2	10·8
„ width of brain-case ...	9	9·3	9·1	9·2	9·6	9·3	8·8	9·7
„ zygomatic width ...	11·3	12·2	11·9	11·8	12·7	12·3	11·5	11·8
„ maxillary width across m^1...	8	8·6	8·3	8·5	8·9	8·6	8·2	
„ across cingula of canines ...	5·6	5·8	5·7	5·6	6	5·8	6	
Mandible, to front of incisors ...	12·8	13·7	13·1	13	14	13·6	13·3	
Upper teeth, c–m^2 ...	6·4	6·8	6·7	6·7	7·2	6·9	6·8	6·8
Lower teeth, c–m_2 ...	6·8	7	6·9	6·8	7·3	7·1	7	7·2
Ear-conch, length, inner margin ...	11·5	12·2	11·9	...	12		11	12
„ length, outer margin ...	15·7	17	16·2	...	16·5		15	
„ width ...	11·3	12·3	11·9	...	12		11	11·8
Tragus, length ...	5	6	5·8	...	6		5·8	
Lancet, length ...	8·2	9·2	8·9	...	8·8		8	8·8
„ width ...	5·2	6	5·5	...	6		5·5	6
Horseshoe, width ...	6	6·6	6·3	...	6·8		6	6·2
Forearm ...	39	42	40·3	41·2	44	42·5	37·8	39·8
Pollex ...	10	10·5	10·2	10	11·8	10·8	9·8	10·2
3rd metacarpal ...	35·5	37	36·3	38·5	41·3	39·4	35·3	37·5
III^1 ...	13·2	14·8	14·4	14·8	16	15·3	12·8	13·5
III^2 ...	18·3	22	20·5	21	22·8	21·7	19·8	19·8
III^3 ...	10·2	11·2	10·7	10·7	12	11·3	9·8	10·8
4th metacarpal ...	34·7	36·2	35·5	37·5	40·7	38·6	34·2	36·2
IV^1 ...	12	12·8	12·3	12	13·7	12·9	11·2	11·2
IV^2 ...	11·7	14·8	13·2	13·2	15	14	12·7	12·8
5th metacarpal ...	35·5	37·8	36·8	39·5	42	40·3	35·5	37·8
V^1 ...	9·2	10·2	9·6	9·8	11	10·2	8·5	8·7
V^2 ...	10	12	11·3	11·2	12	11·8	10	10·2
Interfemoral ...	9	11·2	10·3	...	12		9	11·5
Lower leg ...	13·5	15	14·1	14·8	15·7	15·1	13	14
Foot, with claws ...	9·2	10·2	9·8	10·3	11·5	10·9	9	10
Calcar ...	4·3	4·8	4·7	4·8	5	4·9	5	5

* U.S. N. M. no. 62635.

Range.—The two specimens examined are the only known.

Remark.—*A. rosenbergi* cannot be discriminated, with certainty, by any external character from other species of *Artibeus* of similar size, f. i. *A. watsoni*, *cinereus* (*cinereus*), *toltecus*. But it is unique in the strong reduction of m^2.

Artibeus toltecus Saussure.

Diagnosis.—Molars $\frac{2}{2}$. Cusp 7 of m^1 large. Bony palate not shortened. Forearm 37·5–43·5 mm.

A. toltecus and *cinereus.*—*A. toltecus* cannot be discriminated with certainty by any *external* character from *A. cinereus*. The interfemoral in *A. toltecus* is probably, at least on average, markedly shorter, but of one of the races, *A. t. ravus*, only skins have been available for examination. The skull of *A. toltecus* is almost precisely, in shape as in dimensions, like that of *A. cinereus*, the only difference being a proportionately greater maxillary width in *A. toltecus*. The length of the tooth-rows is practically the same in both species.

Nothwithstanding this close similarity, *A. toltecus* and *cinereus* are not only distinct species, but evidently representatives of two distinct sections of the genus. In *A. glaucus*, *watsoni*, and *cinereus* cusp 7 of m^1 is proportionally small (text-fig. 56 B); in *A. toltecus* and *aztecus* (as well as in *A. quadrivittatus*, *turpis*, and *nanus*) this cusp is largely developed, being equal to about $\frac{1}{5}$ to $\frac{1}{4}$ (in *glaucus*,

Text-fig. 56.

A. *Artibeus toltecus ravus*, ♂ ad. Corondelet, N.W. Ecuador. B.M. 1.6.5.3. Right upper tooth-row (cusp 7 of m^1 large). × $\frac{4}{1}$.

B. *Artibeus cinereus cinereus*, ♂ ad. Para. B.M. 1.7.19.3. Right upper tooth-row (cusp 7 of m^1 small). × $\frac{4}{1}$.

watsoni, and *cinereus* to about $\frac{1}{9}$ to $\frac{1}{7}$) of the whole tooth (text-fig. 56 A). Also cusp 7 of m^2 is in *toltecus* and allied species larger and more distinctly projecting.—The larger cusp 7 of m^1 (and m^2) increases, of course, the breadth of this tooth; there cannot be much doubt that the proportionally slightly larger maxillary width of the skull of *toltecus* (and *aztecus*) mentioned above is a direct consequence of the slightly increased breadth of the molars.

The proportionate length of the bony palate is quite as in all the foregoing species of *Artibeus*, the distance from palation to the hinder margin of the incisive foramina being larger than the distance from palation to basion (compare *A. turpis* and *nanus*, characterised by a shortening of the bony palate, p. 307).

A. toltecus and *aztecus*.—The difference between these two species is pointed out below, p. 306.

m_3 *in A. toltecus*.—In one skull, out of 27 examined, m_3 is present on the right side, entirely wanting on the left; the individual is a young adult male of *A. t. ravus* (Brit. Mus. no. 1.6.5.6). In all the other skulls representing both races and different ages, from immature to very old, m_3 and its alveoli are wanting.

Wings.—The wing-structure very closely resembles that of *A. cinereus*, the only appreciable difference being the slightly shorter proximal phalanges of the third, fourth, and fifth digits; in *A. cinereus* the indices of these phalanges are, respectively, 357, 304, and 239, in *A. toltecus* 342, 289, and 227. For further details see the wing-indices on p. 310.

Hairing on limbs and membranes.—As in *A. cinereus*, but the upper side of the interfemoral more strongly haired, the fur forming a distinct fringe along the posterior margin of the membrane.

Colour.—See *A. t. toltecus* (p. 298) and *A. t. ravus* (p. 300).

Range.—From N. Ecuador to Central Mexico (Durango), but Ecuador individuals (*A. t. ravus*) differ in some respects from Central American and Mexican individuals (*A. t. toltecus*).

Artibeus toltecus toltecus Saussure.

1860. *Stenoderma tolteca* H. de Saussure, Rev. & Mag. de Zool. (2) xii. pp. 427–28, pl. xv. fig. 4 (Oct. 1860).—Type locality: Mexico.
1878. *Artibeus cinereus* (not Gervais) Dobson, Cat. Chir. Brit. Mus. pp. 520–21.—Costa Rica, Guatemala, Mexico.
1882. *Artibeus cinereus* (not Gervais) Thomas, P. Z. S. p. 371.—Durango (Mexico).

Diagnosis.—Averaging larger: forearm 39–43·5 mm. Facial stripes and white edgings to the ears as a rule wanting or indistinct, rarely well developed.

A. t. toltecus and *ravus*.—*A. t. toltecus* can only be discriminated from *A. t. ravus* by average characters. The skull of *A. t. toltecus* averages in every respect a trifle larger (especially broader), but small skulls of *toltecus* are indistinguishable from large skulls of *ravus*. The external dimensions average larger, the forearm and metacarpals being from 2·7 to 3·2 mm. longer. As in *A. t. ravus* there is a dark and a light phase, but the dark phase in *A. t. toltecus* is noticeably darker than in any specimen I have seen of *A. t. ravus*. In most specimens of *A. t. ravus*, both in its dark and light phase, the facial stripes and light edgings to the ears are sharply pronounced; in *A. t. toltecus* they are but rarely well marked, as a rule indistinct or quite undeveloped.

From this it will be seen that it is impossible to draw a

definite line between *A. t. toltecus* and *ravus*; they are evidently a northern and southern representative of one species.

Colour (excluding facial stripes and ear-edgings).—Dark phase:—General colour of upper side very dark, approaching blackish brown (being, rather, a blackish shade of drab), this colour confined to the tips of the hairs; base of hairs drab in the posterior, almost ecru-drab in the anterior part of the upper side. Under side drab.—This is the extreme of the dark phase in adult specimens; it is rather more blackish than the dark phase of *A. watsoni* (p. 289).

Light phase:—In its extreme the light phase is indistinguishable from that of *A. t. ravus* (p. 300).

The dark and light phases are connected by numerous transitional stages, but a majority of the individuals examined are more or less dark-coloured.

Facial stripes and ear-edgings.—In a majority of adult individuals there is no trace of facial stripes nor of white edgings to the ears; but individuals occur in which these light markings are more or less distinct, and sometimes, though rarely, they are fully developed. The subjoined table will show the amount of variation in this respect in 17 adult individuals of *A. t. toltecus* examined, as well as the stronger development

Facial stripes and ear-edgings of adult individuals of A. t. toltecus *and* ravus.

	Locality.	Supraorbital stripes	Infraorbital stripes	White ear-edgings
A. t. toltecus...	Costa Rica (1).	none.	none.	none.
	Nicaragua (1).	indistinct.	indistinct.	none.
	Guatemala (1).	none.	none.	none.
	Oaxaca (2).	none.	none.	none.
	Jalisco (9).	none (5). indistinct (2). distinct (1). strong (1).	none (5). indistinct (2). distinct (2). strong (0).	none (3). indistinct (4). distinct (2). strong (0).
	Vera Cruz (3).	none.	none.	none.
A. t. toltecus...	All localities (17).	none (70 p. ct.). indistinct (18 p. ct.). distinct (6 p. ct.). strong (6 p. ct.).	none (70 p. ct.). indistinct (18 p. ct.). distinct (12 p. ct.). strong (0 p. ct.).	none (65 p. ct.). indistinct (23 p. ct.). distinct (12 p. ct.). strong (0 p. ct.).
A. t. ravus ...	All localities (11).	none (0). indistinct (18 p. ct.). distinct (36 p. ct.). strong (46 p. ct.).	none (0). indistinct (27 p. ct.). distinct (36 p. ct.). strong (37 p. ct.).	none (0). indistinct (0). distinct (27 p. ct.). strong (73 p. ct.).

and apparently much greater constancy of these markings in the southern race, *A. t. ravus*. It is a rather strange fact that, so far as the facial markings are concerned, there is much the same difference between the northern and southern races of *A. toltecus* as between the northern and southern races of *A. jamaicensis*; also in this latter species the facial stripes are stronger and more constant in the southern forms.

Specimens from different localities.—Central American are in every respect indistinguishable from Mexican individuals. The comparative table of measurements below, in which I have arranged the adult individuals examined in four sections according to their habitat, shows this as far as the cranial and external dimensions are concerned.

Measurements of A. toltecus toltecus.

	Costa Rica, Nicaragua, Guatemala.		Oaxaca.		Jalisco, Durango.		Vera Cruz.	
	3 adults, 3 skulls.		2 adults, 1 skull.		9 adults, 5 skulls.		3 adults, 3 skulls.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to front of c	20·5	21	20·6		20·2	21·2	20·8	21·2
„ mastoid width	11	11·5	11		10·7	11·4	11	11·5
„ width of brain-case	9·8	10	9·5		9·5	10·2	9·6	10
„ zygomatic width	12·2	12·7	12·3		12·3	13	12·7	13
„ maxillary width across m^1	9·2	9·8	9·2		9	9·2	9·5	9·8
„ across cingula of canines	6	6·1	6		5·7	6·2	5·8	6
Mandible, to front of incisors	13·2	14	13·4		13·2	14·2	13·8	14
Upper teeth, c–m^2	6·8	7·2	6·8		6·8	7	7	7·1
Lower teeth, c–m_2	7	7·4	7		7	7·2	7·2	7·3
Ear-conch, length, inner margin	11·3	11·8	11	12	12	12·7	12·2	12·5
„ length, outer margin	15·8		15·5	15·8	16·2	18	16·8	
„ width	12	12·2	11·8	12·8	12	13·5	12	13·5
Tragus, length	6		6		6	6·5	.....	
Lancet, length	8·8	9·5	8·5		8·8	9·5	9·7	9·8
„ width	6		...	...	5·5	6·2	6	6·6
Horseshoe, width	6·3	6·5	5·8	5·8	6·2	7·2	6·6	7
Forearm	39·8	42	39	39·8	39	42·5	39·2	43·5
Pollex	10	10·2	10·6	11·4	10	11·8	10	12
3rd metacarpal	37·8	39	36·8	38	35·8	39·8	37	40·5
III^1	13·5	14·2	12·5	13·2	13	14·7	13	15
III^2	20	21	19·8	21	19·2	22	20·2	23·8
III^3	10·5	11	10	11·8	10	12	10·2	12·8
4th metacarpal	36·2	38	35	36·8	35	39	36·2	39
IV^1	11·3	12	11	11·8	11	12·8	11·2	12·5
IV^2	13	14	13	14	12·7	14·3	12·7	14·8
5th metacarpal	37·8	39·3	36·8	37·2	36·8	40·2	37	40·8
V^1	9	9·8	8·7	9	8·2	9·8	8·8	10
V^2	11	11·2	10·2	11·3	10·2	11·8	10	12·2
Interfemoral	7	8·5	6·5	7·5	5	10·5	8	9·8
Lower leg	14·5	15	.....		14	16	13·8	15·7
Foot, with claws	10	10	.....		10	11·8	11	11·7
Calcar	4·2	4·3	4·2		4·2	5·7	4·5	4·8

Specimens examined.—24 specimens (3 skins), 15 skulls, from the following localities:—

British Museum:—Costa Rica (2). Nicaragua: Jinotega, 1100 m. (1). Guatemala: San Geronimo (1). Jalisco: Ambas Aquas, Tepic (2). Durango: Ventanas (2 juv.). "Mexico" (1). Uncertain locality (1).—7 skulls, from all the localities represented by adult specimens.

U.S. National Museum*:—Oaxaca: Juquila (2). Jalisco: Plantinar (7), Teuchitlan (1). Vera Cruz: Mirador (3). Uncertain locality (1).—8 skulls, from all these localities.

Range.—Central America, S. and Central Mexico, as far north as Durango.

Saussure's *Stenoderma toltecum*, 1860.—The essence of the original description is this:—*S. toltecum* is an *Artibeus*, with $\frac{2}{2}$ molars, very short interfemoral (4·5 mm.), the forearm measuring 41 mm., and inhabiting Mexico. The $\frac{2}{2}$ molars exclude all Mexican species of the genus except *A. toltecus*, *phæotis*, *aztecus*, *turpis*, and *nanus*. Of these, *A. phæotis* and *nanus* are excluded by their small size, *A. aztecus* by its larger size, *A. turpis* by its longer interfemoral; leaving only the species here called *A. toltecus*, and, from the locality (Mexico), the race *A. t. toltecus*.

Artibeus cinereus *in Dobson's Catalogue*, 1878.—I have examined the four specimens catalogued by Dobson (*l. s. c.*) as *Artibeus cinereus*; all of them are *A. toltecus toltecus*.

Artibeus toltecus ravus Miller.

1902. *Dermanura rava* Gerrit S. Miller, Jr., Proc. Acad. N. Sci. Philad. p. 404 (12 Sept. 1902).—Type locality: San Javier, N. Ecuador.

Diagnosis.—Similar to *A. t. toltecus*, but facial stripes as a rule distinct or strong, and white edgings to the ears always distinct; general size averaging smaller: forearm 37·5–39·7 mm.

A. t. ravus and *toltecus.*—The differences between these two forms have been pointed out in detail above, under the description of *A. t. toltecus* (pp. 297–299).

Colour.—Adult individuals show a darker and lighter phase, closely resembling those of *A. watsoni*:—

Darker phase: one skin, fully adult, teeth slightly worn (Brit. Mus. no. 1.6.5.5.):—Upper side as in darker-coloured individuals of *A. watsoni* (see p. 289). Under side distinctly darker than in *A. watsoni*, almost broccoli-brown. Facial stripes strong. Whitish ear-edgings very distinct. No light tips to the wings.

Lighter phase: eight skins, fully adult, teeth slightly worn, well worn, or much worn:—Precisely as in light-coloured individuals of *A. watsoni* (p. 290). Facial stripes as a rule strong, or at least distinct, sometimes indistinct, in none completely

* U.S. N. M. nos. 5203, 6979, 6981, 11216, 52082, 52085, 52087–89, 52095–96, 52098, 76512, 76515.

wanting (see table, p. 298). Whitish ear-edgings strong, or at least distinct. No light tips to the wings.—The shade of colour is not quite the same in all of the eight skins; some of them evidently show traces of a darker stage, but none are truly intermediate.

Measurements.—On p. 309.

Specimens examined.—12 skins, with skulls, from the following localities:—

British Museum:—N. Ecuador: Pambilar (3); Corondelet (5).

U.S. National Museum * :—N. Ecuador: Pambilar (2); Corondelet (2); all specimens paratypes of "*Dermanura rava*."

Range.—As yet only known from N. Ecuador.

Miller's *Dermanura rava*, 1902.—Type locality: San Javier, N. Ecuador.—Miller compared *D. rava* with *D. cinerea* (*i. e.* probably Dobson's description of *A. cinereus*, which, however, is taken from examples of *A. t. toltecus*) and *D. tolteca* (i. e. *A. aztecus* of the present paper; I have seen the actual specimen referred to by Miller, U.S. N. M. no. 52051), and found it differing in the following particulars: smaller, the "colour much paler," "the palatine foramina much more numerous," and persisting "as two conspicuous rows of small perforations even in very old individuals."—The type was collected by G. Fleming; all the British Museum examples are from the same collector and practically the same locality; and by the kindness of Mr. Miller and the Authorities of the U.S. National Museum I have had for examination four of his paratypes, so that all doubt as to the identification of *D. rava* is excluded.

Miller apparently laid much stress on the pale colour of *A. t. ravus*, and the four specimens sent from the Washington Museum are, in fact, all light-coloured; but the British Museum series shows that also a dark phase occurs in perfectly adult individuals. Of twelve skins examined, three must be put aside as being either immature or young adults; of the remaining nine, one represents the dark phase, eight the light. Taking in consideration that the specimens were obtained in three different places in N. Ecuador (between August 10th and October 26th), viz., San Javier, Corondelet, and Pambilar, there seems to be some reason for supposing that this strong preponderance of light-coloured individuals is not quite accidental; it may be that a majority of adult individuals of this form are light-coloured. It has been mentioned above (p. 299) that so far as the development of the facial stripes is concerned, there is much the same difference between the northern *A. t. toltecus* and the southern *A. t. ravus* as between the northern and southern races of *A. jamaicensis*; if it proves true that a majority of individuals of *A. t. ravus* are light-coloured, there is another parallelism to *A. jamaicensis*; as pointed out above (p. 256) 77 p. ct. of individuals of the southern races of *jamaicensis* are light coloured, as against only

* U.S. N. M. nos. 113333–34, 113337, 113339.

25 p. ct. in the northern races. But even if this be so, there is at all events no absolute difference in this respect between *A. t. ravus* and the true *A. t. toltecus*, in which latter dichromatism also occurs (see above p. 298). As to the number and persistency of the small palatine perforations, it is a character of no diagnostic value; it varies from individual to individual quite as much as it does from species to species.

Artibeus quadrivittatus Pet.

1865. *Artibeus* (*Dermanura*) *quadrivittatus* Peters, MB. Akad. Berlin (13 July, 1865) p. 358.—Type locality: Surinam.
1878. *Artibeus quadrivittatus* Pet., Dobson, Cat. Chir. Brit. Mus. p. 521.—Surinam; Pernambuco.
1888. *Artibeus quadrivittatus* Pet., Jentink, Cat. Syst. Mamm. p. 209.—Surinam (type specimen).

Diagnosis.—Similar to *A. toltecus*, but upper side of interfemoral and tibia more sparsely haired, and interfemoral averaging somewhat longer. Forearm 41·7–44 mm.

A. quadrivittatus and *toltecus.*—In the shape and size of the skull, in the structure, number, and size of the teeth, and in all external characters, *A. quadrivittatus* is similar to *A. toltecus*, with these two exceptions:—First, in *A. toltecus* the upper side of the interfemoral and tibia is densely haired; in *A. quadrivittatus* the hairs are so short and sparse as to make the interfemoral membrane appear almost naked. Second, in the single alcoholic specimen examined of *A. quadrivittatus* the interfemoral measures, in the middle line, 12·3 mm., whereas the maximum found in a series of *A. t. toltecus* is 10·5 mm.; it probably indicates that the interfemoral *averages* longer in *quadrivittatus*.

The three specimens (two skins) examined are not sufficiently well preserved for a detailed description of the colours; in one the facial stripes are strong, in the others rather indistinct.

Measurements.—On p. 309.

Specimens examined.—Surinam (one, with skull); Pernambuco (two, with skulls); from the collection of the British Museum.

Peters's *Artibeus* (*Dermanura*) *quadrivittatus*, 1865.—Type locality: Surinam; type in the Leyden Museum.—The essence of the short original description is this:—"Von der Grösse und dem Ansehen des *St. toltecum* Saussure, aber mit etwas breiterer und weniger behaarter Schenkelflughaut," and "mit vier weissen Längsbinden auf dem Kopfe." Forearm 40, tibia 14, interfemoral in middle line 9 mm.

From the above there can be no reasonable doubt as to the identification of *A. quadrivittatus*. Peters's measurement of the interfemoral, viz. 9 mm., if compared with the length of this membrane in a British Museum specimen, viz., 12·3 mm., seems to show (which indeed was to be expected) that in the length of the interfemoral there is only an average difference between *A. quadrivittatus* and *A. toltecus toltecus*; in a series of this latter I find it varying from between 5 and 10·5 mm. (average 7·9 mm.),

so that the only, apparently reliable, difference between the two species is the denser hairing of the interfemoral and tibia in *A. toltecus*.

Dobson's *Artibeus quadrivittatus*.—Dobson's description of *A. quadrivittatus* (l. s. c.) may be epitomised in the following four sentences:—First, it is "very similar to *A. cinereus* [i. e. *A. toltecus toltecus*], but the nose-leaf is narrower and not so abruptly narrowed at the summit"; Dobson gives as breadth of the nose-leaf in *A. quadrivittatus* 0″·25, in "*A. cinereus*" 0″·28, making a difference of only 0″·02 or 0·5 mm.; considering the not inconspicuous variation in the breadth of the nose-leaf in all other species, it would, *a priori*, appear highly improbable that such a small difference would prove to be reliable; and as a matter of fact there is no difference at all in this respect between *A. t. toltecus* and *A. quadrivittatus*; in the former the lancet is 5·5–6·6 mm. broad, in the only alcoholic specimen I have seen of the latter (also examined by Dobson) 6 mm.; also the shape of the lancet is the same in the two species. Second, "interfemoral membrane much deeper"; this is only correct, if for "much" we substitute "on an average somewhat." Third, the upper surface of the interfemoral "thinly clothed with fine hairs,"; this is correct (but there is no corresponding character in Dobson's description of his *A. cinereus*). Fourth, "the head with four longitudinal, not very distinct, white streaks, arranged as in *A. perspicillatus* [i. e. *A. jamaicensis lituratus*]", whereas in his *A. cinereus* [*A. t. toltecus*] there are "no white streaks on the face"; but the character is (as might be expected) individually variable in both species (as it also is, more or less, in other forms of the genus); in *A. t. toltecus* the facial stripes are, as a rule, wanting or rather indistinct, but specimens occur in which they are well developed, and, on the other hand, of three examples of *A. quadrivittatus* two have the facial stripes rather indistinct, one strong.—This perusal of Dobson's description, based on the same material as examined by him, leads to the same result as emphasised above: there is, probably, an average difference in the length of the interfemoral, and an apparently well-marked difference in the hairing of this membrane and the tibia, but I am unable to find any other character by which these two extremely closely related species can be discriminated from each other.

Artibeus phæotis Miller.

1902. *Dermanura phæotis* Gerrit S. Miller, Jr., Proc. Acad. N. Sci. Philad. p. 405 (12 Sept. 1902).—Type locality: Yucatan.
1906. ?*Dermanura jucundum* D. G. Elliot, Proc. Biol. Soc. Wash. xix. p. 50 (1 May, 1906).—Type locality: Vera Cruz.

Diagnosis.—Similar to *A. toltecus ravus*, but with somewhat shorter tooth-rows, and no whitish edgings to the ears. Forearm about 38 mm.; third metacarpal about 37 mm.

I have not seen this species, which was described by Miller

from a single example (skin and skull) obtained at Chichen Itza, Yucatan. The following notes are based partly on Miller's published account, but chiefly on more detailed information, photographs of the skull (upper, lateral, and lower views), camera lucida outlines of the molars and the profile of the skull, and measurements of skull and external dimensions kindly given me by Dr. Marcus W. Lyon, Jr., Washington.

Skull.—General shape quite as in *A. t. ravus*. Judging from photographs of the type skull of *phœotis*, I am unable to see any appreciable difference from a series of skulls of *ravus*, but Miller, who in the original description of *phœotis* compared its skull with that of *ravus*, found "the rostrum broader and flatter and the median backwardly extending portion of the bony palate wider."—The measurements, as taken by Dr. Lyon (see table below, p. 309), are practically quite as in *ravus*.

Teeth.—The teeth of the type are very much worn down, but from photographs (twice natural size) and camera lucida outlines of the molars it is quite clear that they accord with those of *A. toltecus*; cusp 7 of m^1 is large, as in this latter species. The tooth-rows are somewhat shorter than in *A. t. ravus*: upper teeth, c–m^2, 6 mm., according to Dr. Lyon, as against 6·5–7 mm. in a series of *ravus*, measured by myself.

Colour.—Miller describes the colour of the fur as closely similar to that of *A. t. ravus*, but the ears are "much darker and without the whitish border." All the specimens of *ravus* I have seen have distinct or strong whitish edgings to the ears (see table above, p. 298).

External dimensions.—I am indebted to Dr. Lyon for measurements of the forearm, third digit, first phalanx of fourth digit, and first phalanx of fifth digit; they are much as in *A. t. ravus*, only the metacarpals would seem to be a trifle longer (see below, p. 309).

Measurements.—On p. 309.

Material examined.—Photographs of the type skull.

Range.—Yucatan; ? Vera Cruz (see below, p. 305, under "*Dermanura jucunda*").

Remarks.—From the available information it appears that *A. phœotis* is very closely related to *A. t. ravus*, differing chiefly in the somewhat shorter tooth-rows and lack of white edgings to the ears.

A species of *Artibeus* described below (p. 308) under the name of *A. nanus*, has like *phœotis* $\frac{2}{2}$ molars and cusp 7 of m^1 large; the forearm measures 36·5–38 mm. (in *phœotis* 38), the upper tooth-row 5·8–6·1 mm. (in *phœotis* 6); in other words, in the form and number of the teeth and, so far as the length of the forearm is concerned, also in external dimensions, the two species are alike; further, *nanus* is known from the Mexican States of Guerrero, Colima, Sinaloa, and Vera Cruz, *phœotis* from Yucatan and, probably, Vera Cruz, so that the distribution of the species is, partly at least, the same. Some words are therefore necessary

to prevent a confusion of these two bats which, though similar in the points mentioned, are widely distinct species :—

The skull of *A. phæotis* is probably of the *toltecus* pattern; in *A. nanus* (and its larger relative *A. turpis*) the rostrum is peculiarly flattened and slightly bent upwards; the profile of the *nanus* skull is therefore very different from that of the *phæotis* skull. In *A. phæotis* the proportionate length of the bony palate is quite as in *toltecus* and allied species: measured from palation to hinder border of incisive foramina, longer than, or at least equal to, distance from palation to basion; in *nanus* (and *turpis*) the palate is shortened: its length (palation to incisive foramina) shorter than the post-palatal portion, from palation to basion. The skull of *nanus* is, on the whole, distinctly smaller than that of *phæotis*. All these differences have been confirmed by Dr. Lyon (in litt.), who kindly compared a skull of my *A. nanus* (U.S. N. M. no. 51765; Colima) with the type skull of Miller's *A. phæotis*.—Also externally the two species, in spite of all similarity, are distinguishable: although the forearm in *phæotis* appears to have the same length as in a large *nanus*, the metacarpals are conspicuously longer; third metacarpal 37·3 mm., against 32·2–35 mm. in a series of *nanus*; also the proximal phalanges are a little longer in *phæotis*.

Elliot's *Dermanura jucunda*, 1906.—Type locality: Achotal, State of Vera Cruz, Mexico. Described from one example, with skull.—According to Elliot, it is "allied to *D. quadrivittatum* from South America, but is smaller, with a considerably smaller skull," and "the nose behind the nose-leaf whitish"; supraorbital stripes "very conspicuous," infraorbital stripes "very indistinct."

Professor Elliot has kindly informed me that the distance from palation to the hinder border of the incisive foramina is slightly *greater* than the distance from palation to basion (thus quite as in the ordinary *Artibeus* skull, not as in *A. nanus* and *turpis*), and given me some measurements of the skull, teeth, and wing (see table p. 309). From these measurements it is evident that the size of the skull and teeth is precisely as in *A. phæotis*. The forearm measures "41·8 mm." (Elliot in litt.; not 43 mm. as stated in the published description), as against "37·9 mm." (Lyon) in *phæotis*, a discrepancy of 3·9 mm.; but Lyon has undoubtedly measured the forearm of *phæotis* to the distal end of the radius (if not, the difference between the length of the forearm and the third metacarpal, respectively 37·9 and 37·3 mm., would certainly be greater), and if Elliot, on the other hand, has measured the forearm of *jucunda* to the front curve of the carpus, then the discrepancy is reduced to about 3 mm., a very reasonable amount of individual variation in an *Artibeus* of this size; further, it should be noticed that Elliot's measurement of the third metacarpal is exactly (to a fraction of a millimetre!) like that of *A. phæotis*, viz. 37·3 mm., and also the length of the phalanges of the third, fourth, and fifth digits practically as in *phæotis*.—The white patch behind the nose-leaf mentioned by

Elliot is of no importance as a specific character; it only means that the supraorbital stripes are fused together in front; the same is often the case in other species, whenever these stripes are strongly developed. The fur is described as "dusky brown," whereas the type specimen of *phæotis*, according to Miller, does not differ in colour from his series of *A. t. ravus*, and therefore probably is pale-coloured; but also this proves nothing about the distinctness of *D. jucunda*; dichromatism is the rule in the species of *Artibeus*.

In brief, neither in the original description of *D. jucunda* nor in the additional information given me by Professor Elliot, am I able to find a single character by which *D. jucunda* can be discriminated from *A. phæotis*. So long as it has not been proved that such characters exist, I must regard the former name as a synonym of the latter.

Artibeus aztecus K. And.

1902. *Dermanura tolteca* (not Saussure) Gerrit S. Miller, Jr., Proc. Acad. N. Sci. Philad. p. 404, footnote (12 Sept. 1902).—Morelos, Mexico (specimen examined).

1906. *Artibeus aztecus* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 422 (1 Dec. 1906).—Type locality: Tetela del Volcan, Morelos, Mexico.

Diagnosis.—Allied to *A. toltecus*, but in every respect somewhat larger; metacarpals unusually long; interfemoral strongly haired. Forearm 45–46·8 mm.

A. aztecus and *toltecus*.—*A. aztecus* has no closer known relative than *A. toltecus*. As in this latter species cusp 7 of m^1 (and m^2) is largely developed, the maxillary width of the skull proportionately large, the number of molars $\frac{2}{2}$. But the skull is in every respect slightly larger and more heavily built, the teeth a little larger. The external dimensions are greater; in the smallest available specimen of *A. aztecus* the forearm is 6 mm. longer than in the smallest *A. t. toltecus*, in the largest specimen 3·3 mm. longer than in the largest *A. t. toltecus*. The metacarpals are unusually lengthened; in *A. toltecus* the indices of the third, fourth, and fifth metacarpals are, respectively, 912, 898, and 923; in *A. aztecus* 946, 928, and 954; the first phalanx of the third digit is of the same length as in *A. toltecus*, but the second phalanx so much lengthened as to be more than $1\frac{1}{2}$ the length of the first; also the second phalanx of the fourth digit is proportionately longer than in *A. toltecus* (compare wing-indices, on p. 310). All these modifications of the wing-structure make, of course, a proportionately longer wing; in *A. toltecus* the indices of the three principal digits are 2037, 1516, and 1419, in *A. aztecus* 2088, 1565, and 1442.

The interfemoral is very short (as in *A. toltecus*) and unusually strongly haired, as is also the upper side of the tibia.

Colour.—The general colour of the fur, in all the four specimens examined, is quite as in the dark-coloured phase of *A. t. toltecus* (above p. 298). Facial stripes very indistinct or completely

wanting. No light edgings to the ears. No light tips to the wings.

Measurements.—On p. 309.

Specimens examined.—Tetela del Volcan, Morelos, Mexico (4, with skulls); from the collection of the U.S. National Museum*.

Range.—As yet only known from Morelos, Mexico.

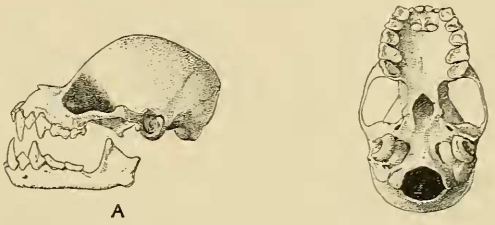
Artibeus turpis K. And.

1906. *Artibeus turpis* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 422 (1 Dec. 1906).—Type locality: Teapa, Tabasco, S. Mexico.

Diagnosis.—Molars $\frac{2}{2}$. Cusp 7 of m^1 large. Rostrum of skull unusually depressed and distinctly bent upward; palate shortened. Larger than *A. nanus*: maxillary tooth-row 6·7 mm., forearm 40·5 mm.

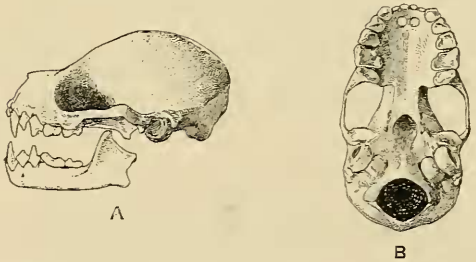
Affinities.—*A. turpis* and *nanus* (below, p. 308) are rather closely related to *A. toltecus* and *quadrivittatus*. As in these

Text-fig. 57.



A, B. *Artibeus nanus*, ♀ ad. Colima. U.S. N. M. 51765. × $\frac{3}{2}$.

Text-fig. 58.



A, B. *Artibeus toltecus toltecus*, ♀ ad. Jalisco. U.S. N. M. 52038. × $\frac{3}{2}$.

species, cusp 7 of m^1 is large, m^3 and m_3 wanting, the rostrum conspicuously broadened. In some specimens of *A. t. toltecus*,

* U.S. N. M. nos. 52050–51, 53769, 53772.

particularly in aged individuals, there is a tendency to flattening of the rostrum and vaulting of the brain-case; in *A. turpis* and *nanus* (text-fig. 57) this tendency has been carried to an extreme, and at the same time the rostrum is bent slightly upward; probably as a consequence of this latter, the bony palate has become shortened. These are the chief peculiarities of *A. turpis* and *nanus* as compared with *A. toltecus* and *quadrivittatus*.

Skull (compare text-fig. 57, of *A. nanus*).—Short and broad, as in *A. toltecus* and *quadrivittatus*. Rostrum more depressed and brain-case more vaulted than usual in the genus. Rostrum with a slight, but distinct, upward trend, the alveolar border of the maxillary bone, therefore, in profile more abruptly ascending; in *A. toltecus* (text-fig. 58) the profile of the nasal bones is slightly descending rather than horizontal, in *A. turpis* it is slightly ascending. Bony palate shortened; in *A. toltecus* (as in all the foregoing species of the genus, with exception of the short-faced *A. concolor*) the length of the palate, from palation to posterior border of incisive foramina, is *larger* than (extremely rarely almost equal to) the length of the post-palatal portion of the skull, from palation to basion; in *A. turpis* the bony palate is *shorter* than the post-palatal portion.

Teeth.—As in *A. toltecus* and *quadrivittatus*. Cusp 7 of m^1 large; cusp 7 of m^2 conspicuous, shelf-like, projecting.

In the nose-leaves, ears, wing-structure (see wing-indices, p. 310), and hairing on tibia and interfemoral, *A. turpis* does not differ appreciably from *A. toltecus*.

Colour (♀ ad., preserved in alcohol; teeth almost unworn; type of species).—General colour of upper side approaching Prout's brown, but with a distinct tinge of drab; base of hairs on hinder back almost wood-brown, on the neck and shoulder region ecru-drab; under side light wood-brown. Facial stripes strong. Narrow light margins to the ears. No white tips to the wings.—The general colour of this specimen has probably not remained quite uninfluenced by the preserving-fluid.

Measurements.—On p. 309.

Specimens examined.—One adult female, Teapa, Tabasco, S. Mexico; with skull; the type; British Museum.

Range.—As yet only known from the type specimen described above.

Artibeus nanus K. And.

1906. *Artibeus nanus* Knud Andersen, Ann. & Mag. N. H. (7) xviii. p. 423 (1 Dec. 1906).—Type locality: Tierra Colorada, Sierra Madre del Sur, Guerrero, Mexico.

Diagnosis.—Similar to *A. turpis*, but in every respect smaller. Maxillary tooth-row 5·8–6·1 mm.; forearm 36·5–38 mm.

A. nanus and *turpis*.—The chief peculiarities of *A. turpis* reoccur in *A. nanus*, if anything in a still more pronounced degree:—the depression and slightly ascending trend of the rostrum, the shortening of the bony palate, the high brain-case,

Measurements of Artibeus toltecus, quadrivittatus, phæotis, aztecus, turpis, *and* nanus.

	A. toltecus toltecus.			*A. toltecus ravus.*			*A. quadrivittatus.*		*A. phæotis.*		*A. aztecus.*		*A. turpis*	*A. nanus.*		
	18 adults, 13 skulls.			11 adults, 11 skulls.			3 adults, 3 skulls.		Type of *phæotis.* (Lyon in litt.)	Type of *jucundus.* (Elliot in litt.)	4 adults, 4 skulls.		♀ ad. Type.	8 adults, 5 skulls.		
	Min.	Max.	Med.	Min.	Max.	Med.	Min.	Max.			Min.	Max.		Min.	Max.	Med.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Skull, total length to front of c	20·2	21·2	20·8	19·3	20·6	19·9	20·5		19·2	19·3	22	22·8	20	18·2	18·7	18·5
„ mastoid width	10·7	11·5	11·1	10	10·8	10·4	10·8		10·2	10	11·4	11·8	.....	9·8	9·8	9·8
„ width of brain-case	9·5	10·2	9·8	8·8	9·5	9·1	9·6	9·7	.....	.....	10·6	10·6	9·3	8·8	9·1	9
„ zygomatic width	12·2	13	12·6	11·2	12	11·8	12·2	12·8	11·8	11·6	...	13·6	12	11·5	12	11·7
„ maxillary width across m^1	9	9·8	9·3	8·3	8·8	8·6	8·8	9·2	8·2	8·1	9·3	9·8	9	8·2	8·5	8·3
„ across cingula of canines	5·7	6·2	5·9	5·5	6	5·8	5·8	6·2	.....	.....	6	6·1	5·8	5	5·4	5·2
Mandible, to front of incisors	13·2	14·2	13·7	12·6	13·7	13·1	13·7	14·1	12·3	12·4	14·7	15	13	11·8	12·2	12
Upper teeth, c–m^2	6·8	7·2	6·9	6·5	7	6·8	6·8	6·8	6	.....	7·5	7·6	6·7	5·8	6·1	6
Lower teeth, c–m_2	7	7·4	7·1	6·8	7·2	7	7·1	7·2	6·5 *	6·7	7·5	7·8	7	6·2	6·5	6·3
Ear-conch, length, inner margin	11	13	12·2		.....		12·2		.....	.....	12·8	13·2	12·2	11	12·5	11·8
„ length, outer margin	15·5	18	16·6		.....		16·8		.....	.....	18	18	16	14	17	15·8
„ width	11·8	14	12·7		.....		12		.....	.....	13	13·2	13	10·5	12	11·4
Tragus, length	6	6·5	6·3		.....		5·8		.....	.....	.....		6	5·5	6	5·7
Lancet, length	8·5	9·8	9·2		.....		9		.....	.....	8·5	9·2	9·5	7·8	8·7	8·2
„ width	5·5	6·6	5·9		.....		6		.....	.....	5·2	6·3	6·2	5	6·2	5·5
Horseshoe, width	5·8	7·2	6·5		.....		6		.....	.....	...	6·7	6·8	5·7	6·3	6
Forearm	39	43·5	41·9	37·5	39·7	38·7	41·7	44	37·9 †	41·8	45	46·8	40·5	36·5	38	37·2
Pollex	10	12	10·7	9·2	11	10·4	.....		.....	.....	11·3	12·5	9·7	9	10	9·4
3rd metacarpal	35·8	40·5	37·7	33	36	34·8	37·8	39·2	37·3	37·3	42	45	37	32·2	35	33·6
III^1	12·5	15	13·7	12	14·7	13·6	14	14·5	13·7	13	15	16·3	14	12	13·2	12·7
III^2	19·2	23·8	20·7	17·5	20·2	19·2	21·2	21·8	18	19·2	24	24·8	21	17·8	19·7	18·8
III^3	10	12·8	11·1	9·2	11·8	10·5	11		.....	.....	11·8	12·8	11·7	8·8	10·7	9·8
4th metacarpal	35	39	37	32·8	36	34·3	36·8	38	.....	.....	41·7	44	37	31·5	34·8	33·1
IV^1	11	12·8	11·7	10	12·2	11·5	12·2	12·8	11·8	11·7	12·8	13·7	11·4	10·3	11·3	10·9
IV^2	12·7	14·8	13·5	11·5	13·2	12·3	13·3		.....	.....	15·5	16·7	13·8	12	13	12
5th metacarpal	36·8	40·8	38·2	33·6	36·2	35·2	38	39	.....	.....	42·8	45	37	32	35·8	34
V^1	8·2	10	9·1	8·6	10	9·1	9·2	10·2	9·7	9·8	9·8	10·8	9·7	8·2	9·5	8·9
V^2	10·2	12·2	11	9·7	10·8	10·2	11·8		.....	.....	11·5	12·8	12·2	9·7	11	10·3
Interfemoral	5	10·5	7·9		.....		12·3		.....	.....	5	6·8	10	9·2	11·7	10·7
Lower leg	13·8	16	14·9		.....		14·7		.....	.....	16·3	17·2	14·5	13·2	14	13·8
Foot, with claws	10	11·8	10·8		.....		10·2		.....	.....	11·2	12·8	10	9·3	10	9·7
Calcar	4·2	5·7	4·8	4	4·2	4·1	4·2		.....	.....	5·8	6	4·2	3·2	4·8	4·2

* Estimated (m^2 lost).

† Probably measured to the distal end of the radius, not (as elsewhere in the present paper) to the front curve of the carpus.

the very broad skull (text-fig. 57 on p. 307); cusp 7 of m^1 and m^2 are relatively large, as in *A. toltecus*, *quadrivittatus* and *turpis*; m_3 absent (five skulls examined); facial stripes strong. But *A. nanus* is conspicuously smaller than *A. turpis*; so far as my material goes, there seems to be a perfectly clear line of separation between the two species; in the *largest* example (among 12 specimens and 5 skulls) of *A. nanus* the skull is 1·3, the maxillary tooth-row 0·6, the forearm 2·5, and the third metacarpal 2 mm. shorter than in *A. turpis*. For further details see the table of measurements, p. 309.

Colour (adult skin; Buena Vista, Vera Cruz; U.S. N. M. no. 112791).—Upper side dark brown, with a tinge of drab; under side broccoli-brown. Facial stripes strong. Conspicuous light margins to the ears. No light tips to the wings.—A series of alcoholic specimens are noticeably lighter-coloured; in all the facial stripes are very distinct; the light ear-edgings sometimes obsolete.

Specimens examined.—12 specimens (one skin) and 5 skulls, from the following localities:—

British Museum:—Guerrero: Tierra Colorada, Sierra Madre del Sur (3). Sinaloa: Presidio, near Mazatlan (1).—3 skulls, representing both localities.

U.S. National Museum*:—Colima: Hacienda Magdalena (7). Vera Cruz: Buena Vista (1).—2 skulls of adult specimens of the series from Colima (the skull of the single example from Vera Cruz has been lost).

Range.—Mexico, as far north as Sinaloa. Sinaloa is the most northern locality from which any species of *Artibeus* has been recorded.

Remarks.—The differences between *A. nanus* and *A. phæotis* have been pointed out above, pp. 304–305.

Wing-indices.

	Forearm.	3rd digit.				4th digit.			5th digit.		
		Mtc.	1 ph.	2 ph.	3 ph.	Mtc.	1 ph.	2 ph.	Mtc.	1 ph.	2 ph.
U. bilobatum and *thomasi* (25 specim.)	1000	938	347	518	275	912	294	317	926	231	280
A. planirostris (85 specim.)	1000	903	297	483	262	883	260	324	905	197	244
A. hirsutus (8 specim.)	1000	887	281	481	261	868	245	313	891	186	231
A. jamaicensis (225 specim.)	1000	900	298	492	259	884	259	318	913	201	245
A. glaucus and *watsoni* (10 specim.)	1000	897	354	510	264	884	296	317	920	224	261
A. cinereus (18 specim.)	1000	912	357	510	266	896	304	329	932	239	278
A. toltecus and *quadrivittatus* (32 specim.)	1000	912	342	501	272	898	289	329	923	227	269
A. aztecus (4 specim.)	1000	946	342	532	268	928	288	349	954	222	266
A. turpis and *nanus* (9 specim.)	1000	903	341	505	263	890	293	323	914	240	277

* U.S. N. M. nos. 51765–67, 51771, 51773–74, 51776, 112791.

Summary of characters of Genera, Species, and Subspecies.

a. Skull long and slender; rostrum but very slightly depressed: height at p^4 greater than, or equal to, width of skull at postorbital constriction; bony palate long: distance from palation to front of incisors about equal to zygomatic width; median backwardly extending portion of bony palate long, equal to combined length of m^1 and m^2; anterior nasal opening less oblique. Outer upper incisors bifid; cusp 2 of m_1 small; molars $\frac{3}{3}$; m^3 larger (than in *Artibeus*), situated in row behind (not postero-internally to) m^2, almost as broad as hinder border of m^2; cusp 5 of m^2 situated near the labial margin of the tooth. A narrow line of whitish fur down the middle of the back ..... Uroderma, p. 212.

a^1. Length of skull (to front of c) 22–23·3 mm.; upper teeth (c–m^3) 7·5–8·5. Length of ear-conch (outer margin) 15·7–16·8; width of horseshoe 6·2–7·5. (S. Brazil and Peru to Costa Rica.) ... *U. bilobatum*, p. 217.

b^1. Length of skull (to front of c) 24·7–24·8 mm.; upper teeth (c–m^3) 8·9–9. Length of ear-conch (outer margin) 18–18·5; width of horseshoe 7·8–8. (Bolivia.) ..... *U. thomasi*, p. 221.

b. Skull short and broad; rostrum considerably depressed: height at p^4 much less than width of skull at postorbital constriction; bony palate short: distance from palation to front of incisors much less than zygomatic width; median backwardly extending portion of bony palate short, much less than combined length of m^1 and m^2; anterior nasal opening more oblique. Outer upper incisors simple (not bifid); cusp 2 of m_1 strongly developed, raised as a high slender cone near the middle of the lingual margin of m^1; molars $\frac{3}{3}$, $\frac{2}{3}$, or $\frac{2}{2}$. No white longitudinal dorsal stripe.

c^1. Median upper incisors simple (not bifid); molars $\frac{3}{3}$; m^3 and m_3 larger (m_3 equal to about $\frac{1}{4}$ of m_2); m^3 situated in row behind (not postero-internally to) m^2; cusp 5 of m^2 situated near the lateral margin of the tooth. Tragus with a pointed projection on inner margin near tip..... Enchisthenes, p. 221.

d^1. Median upper incisors bifid; molars $\frac{3}{3}$, $\frac{2}{3}$, or $\frac{2}{2}$; m^3 and m_3 (when present) smaller (m^3, if not wanting, equal to $\frac{1}{8}$–$\frac{1}{12}$ of m_2); m^3, if not wanting, situated postero-internally to m^2; cusp 5 of m^2 moved lingually so as to occupy (precisely or nearly) the middle of the posterior margin of the tooth. No pointed projection on inner margin of tragus near tip ..... Artibeus, p. 224.

a^2. Molars $\frac{3}{3}$.

a^3. Teeth small: upper row (c–m^2) about 7·2 mm. Rostrum shorter. Forearm 50 mm. (Guiana, Brazil.) ..... *A. concolor*, p. 232.

b^3. Teeth larger: upper row (c–m^2) 9·5–12 mm. Rostrum longer. Forearm 53·7–73 mm.

a^4. Tibia and distal part of interfemoral so short-haired as to appear almost naked; colour of fur of upper side not drab. Upper teeth (c–m^2) 9·8–12 mm.; forearm 55–73 mm. ..... *A. planirostris*, p. 234.

a^5. Smaller. Length of skull (to front of c) 27–30 mm.; zygomatic width 16·2–19·2; upper teeth (c–m^2) 9·8–11. Forearm 55–65·2.

a^6. Average length of skull (to front of c) 28·5 mm.; average zygomatic width 17·6. Average length of forearm 61·8. (Continental: Brazil to S. Mexico)... *A. p. planirostris*, p. 237.

b^6. Average length of skull 27·8 mm.; average zygomatic width 16·8. Average length of forearm 57·7. (Trinidad, Tobago.) ..... *A. p. trinitatis*, p. 241.

c^6. Average length of skull 28·9 mm.; average zygomatic width 18. Average length of forearm 59·4. (Grenada.) ..... *A. p. grenadensis*, p. 241.

b^5. Very large. Length of skull (to front of c) 29·5–33 mm.; zygomatic width 18·3–20·8; upper teeth (c–m^2) 10·4–12. Forearm 62·8–73. (Guiana, Para, Lower Orinoco.) ..... *A. p. fallax*, p. 242.

b^4. Tibia and interfemoral densely haired above; colour of fur of upper side in adults drab with a silvery tinge. Upper teeth (c–m^2) 9·5–10·4 mm.; forearm 53·7–59·7 mm. (Mexico.) ..... *A. hirsutus*, p. 245.

b^2. Molars $\frac{3}{3}$.

c^3. Large: forearm 54–76 mm. ..... *A. jamaicensis*, p. 247.

c^4. Smaller races: length of skull (to front of c) 26–30 mm.; forearm 54–66 mm. Angular notch in hinder border of m^2, between cusps 5 and 7 (place of lost m^3), as a rule distinct, rarely quite obliterated; darker colour phase predominant; facial stripes as a rule wanting or faint, rarely strongly developed. (Northern races: Greater Antilles, as far east as St. Kitts; S. Mexico, C. America; extending to Colombia and Ecuador.)

c^5. Average: length of skull (to front of c) 26·9 mm.; upper teeth (c–m^2) 9·7; forearm 56·8. (Cuba.) ..... *A. j. parvipes*, p. 261.

d^5. Average: length of skull 27·4 mm.; upper teeth 9·9; forearm 59·6. (Yucatan, Belize.) ..... *A. j. yucatanicus*, p. 263.

e^5. Average: length of skull 28·3 mm.; upper teeth 10·3; forearm 60·1. (Greater Antilles, except Cuba, as far east as St. Kitts; Caribbean Islands; S. Mexico, except Yucatan; C. America.) *A. j. jamaicensis*, p. 265.

f^5. Average: length of skull 29·7 mm.; upper teeth 11; forearm 62·9. (Ecuador, Colombia.) ..... *A. j. æquatorialis*, p. 270.

d^4. Larger races: length of skull (to front of c) 29·5–34 mm.; forearm 60–76 mm. Angular notch in hinder border of m^2, between cusps 5 and 7 (place of lost m^3), as a rule reduced or obliterated, rarely perfectly preserved; lighter colour phase predominant; facial stripes distinctly or strongly developed, rarely wanting. (Southern races: S. America, extending to S. Mexico; from Trinidad to Guadeloupe; unrepresented in the Greater Antilles.)

g^5. Averaging larger: forearm 64–76 mm. (S. America, extending to S. Mexico; Trinidad and St. Vincent.) ..... *A. j. lituratus*, p. 272. / *A. j. palmarum*,* p. 278.

h^5. Averaging smaller: forearm 60–66·2 mm. (Dominica, Guadeloupe.) ..... *A. j. præceps*, p. 283.

d^3. Small: forearm 37·2–43·8 mm.

e^4. Forearm 43·8 mm.; third metacarpal 39·4 mm. (Peru.) ..... *A. glaucus*, p. 285.

f^4. Forearm 37·2–40·5 mm.; third metacarpal 33·7–36·2 mm. (C. America.) ..... *A. watsoni*, p. 288.

* Practically indistinguishable from *A. j. lituratus*.

c^2. Molars $\frac{3}{3}$. All species small: forearm 36·5–46·8 mm.
e^3. Cusp 7 of m^1 less developed.
g^4. m^2 not reduced in size; equal to $\frac{2}{3}$–$\frac{3}{4}$ of m^1 ..... *A. cinereus*, p. 290.
i^5. Averaging smaller: maxillary width of skull (across m^1) 8–8·6 mm.; forearm 39–42 mm. (Para, through Guiana to N.W. Venezuela, incl. Trinidad) ..... *A. c. cinereus*, p. 292.
j^5. Averaging larger: maxillary width of skull 8·5–8·9 mm.; forearm 41·2–44 mm. (Colombia, to N.W. Venezuela.) ..... *A. c. bogotensis*, p. 293.
h^4. m^2 considerably reduced in size: equal to only about $\frac{1}{2}$ of m^1. Forearm 37·8–39·8 mm. (Ecuador, Venezuela.) ..... *A. rosenbergi*, p. 293.
f^3. Cusp 7 of m^1 more developed.
i^4. Rostrum not unusually depressed and not bent upward; bony palate not shortened; distance from palation to hinder border of incisive foramina greater than (or equal to) distance from palation to basion.
k^5. Rather smaller: length of skull (to front of c) 19·2–21·2 mm.; upper teeth (c–m^2) 6–7·2; forearm 37·5–44; third metacarpal 33–40·5.
d^6. Upper teeth (c–m^2) 6·5–7·2 mm.
a^7. Upper side of interfemoral densely haired ..... *A. toltecus*, p. 296.
a^8. Averaging larger: forearm 39–43·5 mm. Darker colour phase predominant; facial stripes and white ear-edgings as a rule wanting or indistinct, rarely strong. (S. America, S. and C. Mexico.). *A. t. toltecus*, p. 297.
b^8. Averaging smaller: forearm 37·5–39·7 mm. Light colour phase predominant; facial stripes and white ear-edgings as a rule distinct or strong, rarely wanting. (Ecuador.) ..... *A. t. ravus*, p. 300.
b^7. Upper side of interfemoral sparsely haired. Forearm 41·7–44 mm. (Guiana, Pernambuco.) ..... *A. quadrivittatus*, p. 302.
e^6. Upper teeth (c–m^2) 6 mm. No white ear-edgings. Forearm about 38 mm. (Yucatan, Vera Cruz.) ..... *A. phæotis*, p. 303.
l^5. Rather larger: length of skull (to front of c) 22–22·8 mm., upper teeth (c–m^2) 7·5–7·6; forearm 45–46·8; third metacarpal 42–45. Interfemoral very short, densely haired. Facial stripes indistinct or wanting; no white ear-edgings. (S. Mexico.) ..... *A. aztecus*, p. 306.
j^4. Rostrum unusually depressed and slightly bent upward; bony palate shortened: distance from palation to binder border of incisive foramina less than distance from palation to basion.
m^5. Larger: length of skull (to front of c) 20 mm.; upper teeth (c–m^2) 6·7; forearm 40·5; third metacarpal 37. (S. Mexico.) ..... *A. turpis*, p. 307.
m^5. Smaller; length of skull 18·2–18·7 mm.; upper teeth 5·8–6·1; forearm 36·5–38; third metacarpal 32·2–35. (S. and C. Mexico.) ..... *A. nanus*, p. 308.

General Remarks.

(a) *Artificial and natural arrangement of the species.*—The arrangement of the species of *Artibeus* given in the foregoing pages is based primarily on their number of molars : $\frac{3}{3}$, $\frac{2}{3}$, or $\frac{2}{2}$; it has the practical advantage of facilitating the identification of the species ; it is easier to *count* the teeth than to study their detailed structure. But I have no doubt that it is thoroughly artificial. Briefly epitomised the arrangement is this :—

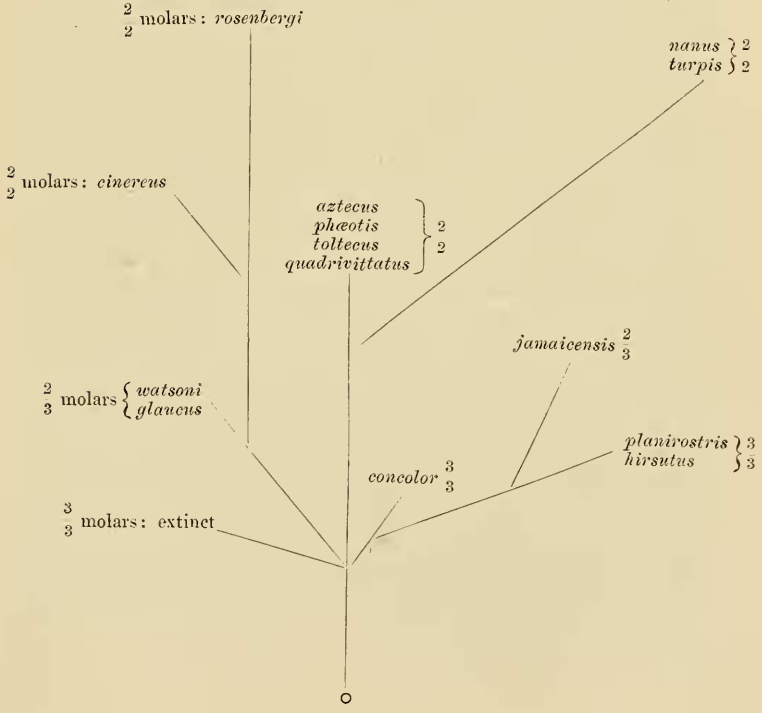
A. $\frac{3}{3}$ molars.
  a. Cusp 7 of m^1 small : no living species.
  b. Cusp 7 of m^1 large : *concolor, planirostris, hirsutus.*
B. $\frac{2}{3}$ molars.
  a. Cusp 7 of m^1 small : *glaucus, watsoni.*
  b. Cusp 7 of m^1 large : *jamaicensis.*
C. $\frac{2}{2}$ molars.
  a. Cusp 7 of m^1 small : *cinereus, rosenbergi.*
  b. Cusp 7 of m^1 large : *quadrivittatus, toltecus, phæotis, aztecus* :—*turpis. nanus.*

This and any other arrangement of the species based primarily on the number of molars is, I believe, open to the following objections :—Is it likely that the presence or absence of a *rudimentary* tooth (m^3 and m_3) is more important, in taxonomic respect, than the general level of development at which the structure of the upper molars (small or large cusp 7 in m^1) has arrived ? It has been pointed out in the foregoing pages that a certain small percentage of individuals of the species with normally $\frac{3}{3}$ molars have $\frac{2}{3}$ only (see *A. planirostris* and *hirsutus*) ; that in the species with normally $\frac{2}{3}$ molars individuals occur which have $\frac{2}{2}$ only (see *A. jamaicensis*) ; and that a few individuals of species with normally $\frac{2}{2}$ molars have $\frac{2}{3}$ (see *A. rosenbergi* and *toltecus*) : bearing this in remembrance, is it then likely that a character which is vacillating among individuals of the same species and geographical race is of primary, and a character which is constant within the species (the structure of the upper molars) of secondary importance ? If the *number* of molars were of fundamental importance in this genus, is it then likely that we should find in the lowest section ($\frac{3}{3}$ molars) species which have the most advanced structure of the upper molars (*planirostris, hirsutus*), and among the species of the highest section ($\frac{2}{2}$ molars) such as have retained a low character (small cusp 7) in the upper molars ? Is it likely that *A. jamaicensis*, because it has lost the rudimentary m^3 (although some of the races have as a rule retained the notch in m^2 indicative of the former place of m^3), is more closely related to *A. glaucus* and *watsoni*, from which it differs in the structure of the upper molars, than to *A. planirostris*, with which it accords in this as in every other respect except the loss of a rudimentary tooth ? These and similar considerations seem, with necessity, to lead to the conclusion that the old and till now universally accepted arrangement of the species according to their number of

molars does not give an adequate idea of their true mutual relationships. If, however, we take as the leading character, not the presence or absence of the vanishing m^3 and m_3, but the smaller or greater development of cusp 7 of m^1, all the objections indicated above, as far as I can see, are removed, and we then arrive at the following scheme :—

A. Cusp 7 of m^1 relatively small.
  a. Molars $\frac{3}{3}$: no living species.
  b. Molars $\frac{2}{3}$: *glaucus*, *watsoni*.
  c. Molars $\frac{2}{2}$.
    α. m^2 of normal size : *cinereus*.
    β. m^2 reduced : *rosenbergi*.
B. Cusp 7 of m^1 large.
  a. Molars $\frac{3}{3}$.
    α. Rostrum short : *concolor*.
    β. Rostrum normal : *planirostris*, *hirsutus*.
  b. Molars $\frac{2}{3}$ (species closely allied to *planirostris*) : *jamaicensis*.
  c. Molars $\frac{2}{2}$ (none of the species closely allied to those of sections B *a* and B *b*).
    α. Rostrum and palate normal ; *quadrivittatus*, *toltecus*, *phæotis*, *aztecus*.
    β. Rostrum unusually flattened, palate shortened : *turpis*, *nanus*.

Or expressed in the form of a diagram :—



According to this arrangement there are two principal branches of the genus: in the one, and more primitive, cusp 7 of m^1 is proportionally small, in the other it is largely developed. The former, as being the more primitive, is quite naturally but poorly represented among recent species; the latter is flourishing. Of the lowest section (molars $\frac{3}{3}$) of the primitive branch (small cusp 7) no living species are known, but there are species with $\frac{2}{3}$ molars (*glaucus*, *watsoni*), and $\frac{2}{2}$ molars (*cinereus*, *rosenbergi*); the latter species, *rosenbergi*, has attained an unusually high development (not only loss of m^3 and m_3, but also reduction of m^2 and m_2). Of the higher branch (large cusp 7) all sections are represented by recent species: $\frac{3}{3}$ molars in *concolor* (peculiarly short-faced), *planirostris* and *hirsutus*, the two latter species very closely allied; $\frac{2}{3}$ in *jamaicensis*, otherwise differing in next to nothing from *planirostris*; $\frac{2}{2}$ in quite a number of species (*quadrivittatus*, *toltecus*, *phæotis*, *aztecus*, *turpis*. *nanus*), among which *turpis* and *nanus* mark the highest stage of development, in so far as the rostrum has become unusually depressed and the palate shortened.

(b) Artibeus planirostris *and its races.*—*A. planirostris planirostris* has spread over the whole continental area from Central Brazil to S. Mexico; the complete resemblance, even in average size, between specimens from Mexico and S. America, and the absence of the race from any of the West Indian Islands, are evidence that it has reached Central America (N. of the Nicaragua depression) and Mexico in a very recent epoch, at all events at a time when the Greater Antilles were separated from the mainland by water of sufficient breadth to constitute an absolute barrier for the spreading of the race from the latter into the former. *A. p. trinitatis* is apparently confined to the Venezuelan coast islands, Trinidad and Tobago, *A. p. grenadensis* to Grenada. These three races are so extremely closely inter-related, being distinguishable only by small average differences in size, that from a broader point of view they may be regarded as one form. In relatively strong contrast to this form stands the large-skulled, large-toothed, and as a rule also externally larger-sized *A. p. fallax*, the true home of which seems to be Guiana, a part of S. America which in a late geological epoch constituted an isolated insular area; all the Guianan specimens of *A. planirostris* I have seen (51 in number, collected at different places, by different collectors, and at different times) are *A. p. fallax*; if, therefore, Guiana is the place of origin of this race, it has spread from there to the Lower Orinoco (Ciudad Bolivar) and Lower Amazons (Para); along the numerous southern affluents of the Amazons it has probably made its way to Peru ("*A. hercules*," apparently indistinguishable from *A. p. fallax*).

(c) *The races of* Artibeus jamaicensis, *their geographical distribution, and its bearing on a past connection of the West Indies and the Central American mainland* (see map, p. 319).—(1) The seven races of *Artibeus jamaicensis* recognised in this paper fall into two natural groups:—*A. j. parvipes*, *yucatanicus*, *jamaicensis*, and *æquatorialis* on the one side; *A. j. lituratus*, *palmarum*, and *præceps* on the other side. The former group, which may be called the "northern," is distributed over Central America, South and Central Mexico, and the Greater Antilles, and has sent a branch southward, through the Cordilleras, as far as Ecuador. The latter group, the "southern," ranges from Paraguay and S. Brazil northward through South and Central America to Central Mexico, and has sent a branch to the Windward Islands, as far north as Guadeloupe.

(2) In the northern group of races the individuals are generally considerably smaller; the angular notch in the posterior margin of m^2, between its cusps 5 and 7, is generally as well marked as in *A. planirostris*, sometimes reduced, rarely completely filled up; the coloration of the fur is chiefly of the dark type, the facial stripes as a rule obsolete or less distinct. In the southern group the individuals are generally considerably larger; the angular notch in the posterior margin of m^2 is rarely well preserved, generally more or less reduced, often completely filled up; the coloration chiefly of the lighter type, with the facial stripes, particularly the supraorbital stripes, as a rule well marked or even very strong.

(3) The close resemblance between *A. j. parvipes*, from Cuba, and *A. j. yucatanicus*, from Yucatan,—closer than between *A. j. parvipes* and its nearest eastern and southern neighbour (in San Domingo and Jamaica), *A. j. jamaicensis*—is evidence of a past closer land connection (or approximation) between Cuba and Yucatan, than between Cuba and San Domingo, or Cuba and Jamaica.

(4) *A. j. jamaicensis* ranges from Central Mexico to Panama, from Honduras to Jamaica, San Domingo, Porto Rico, as far east as St. Kitts. The perfect resemblance between individuals from all these places is evidence of a past complete, or nearly complete, connection between Jamaica and the coast of Honduras and Nicaragua. I do not see any other reasonable explanation of the fact that precisely the same race occurs in Central America, Jamaica, San Domingo, and Porto Rico, whereas Cuba is inhabited by a clearly different race, the relationships of which are with the Yucatan, not with the Jamaican, race. The past connection between Jamaica and the mainland may have been complete; but this assumption is not necessary to explain the present distribution of *A. j. jamaicensis*; the Mosquito Coast and Jamaica are, as well known, connected by extensive submarine banks, the Mosquito and S. Pedro banks (part of the latter above the surface of the water); an elevation of about 100 fathoms

would leave between the Mosquito Coast and Jamaica only two channels, the wider 75 miles; these channels would be so narrow as to form no serious barrier for the spreading of a bat.

(5) The geological line of separation between the Larger and Lesser Antilles runs, probably *, between the Virgin Islands and Anguilla; the Virgin Islands therefore belong geologically to the Larger, Anguilla to the Lesser Antilles. Though Antillean and Central American in origin, *A. j. jamaicensis* has in the course of time crossed this line; coming from west (Porto Rico) it has spread a little east of the line, at least as far as St. Kitts. But there, or in some neighbouring island, the range of the race seems to terminate; farther southward in the chain of the Lesser Antilles (Guadeloupe, Dominica) is found a race (*A. j. præceps*) which has no direct phylogenetic connection with *A. j. jamaicensis*, but is an offshoot of the S. American *A. j. palmarum*.

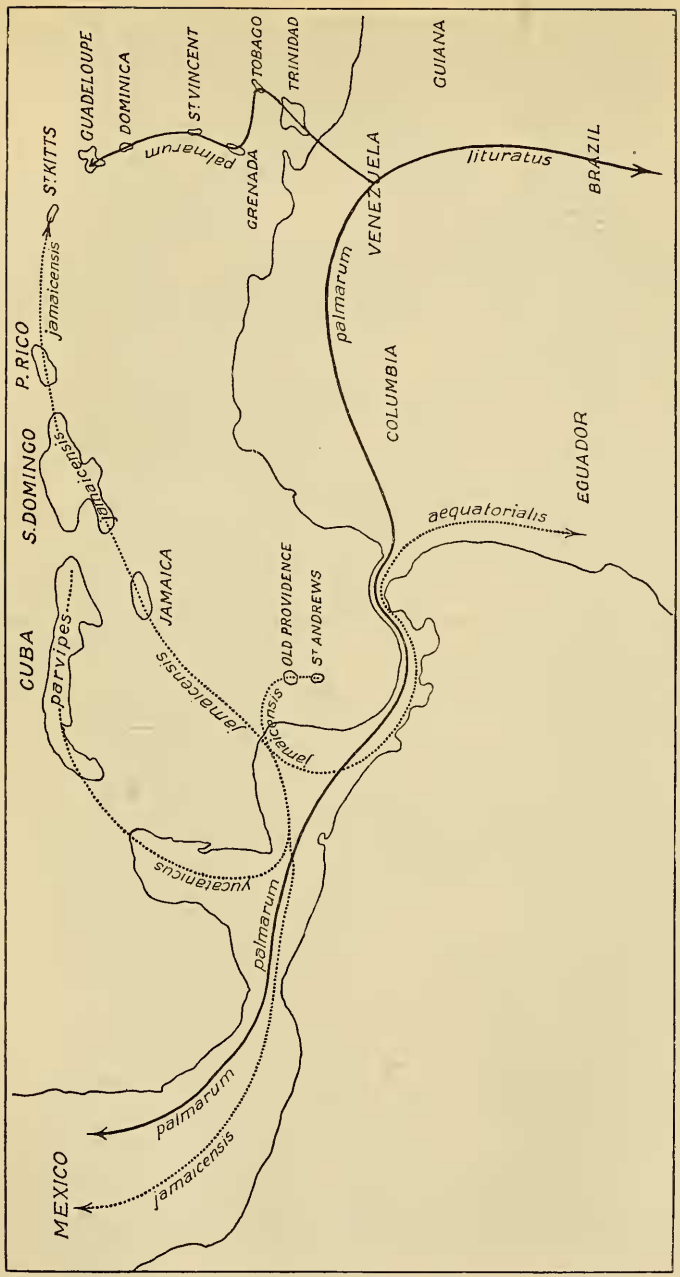
(6) The direct connection between the northern and southern American continent has given *A. j. jamaicensis* the opportunity of spreading southward, through the Cordilleras, as far as Ecuador, where it has developed into the comparatively large-sized, large-skulled, and large-toothed *A. j. æquatorialis*.

(7) While it is safe to assume that *A. j. parvipes*, *yucatanicus*, and *jamaicensis* are of "northern," *i. e.* Central American-Antillean, origin, and *A. j. æquatorialis* an Andean offshoot of this northern branch, it is equally beyond doubt that *A. j. lituratus* and *palmarum* are of S. American origin, for the following reasons:—first, *A. j. palmarum*, from Venezuela, is so extremely closely related to *A. j. lituratus*, from Brazil and Paraguay, as to be, for all practical purpose, indistinguishable; given that *A. j. lituratus* is of S. American origin, *A. j. palmarum* is therefore the same; second, the range of *A. j. palmarum* extends from Venezuela, through C. America to S. Mexico, but the race is completely absent from the Larger Antilles, an evidence that it has reached C. America and Mexico at a time when the Larger Antilles were definitely separated from the mainland; third, whereas *A. j. jamaicensis* is common (and equally common) everywhere in C. America and S. Mexico, *A. j. palmarum* becomes rarer and rarer farther north in C. America, until in S. Mexico it is very rare, an additional evidence that *A. j. jamaicensis* is the indigenous race, *A. j. palmarum* an immigrant from the south.

(8) The southern group has spread from the mainland over the Windward Islands. Individuals from the Venezuelan coast islands, Trinidad and St. Vincent, are indistinguishable from the continental *A. j. palmarum*. But farther north, in Dominica and Guadeloupe, they have developed into a slightly different race, *A. j. præceps*.

* A. Agassiz, Three Cruises of the 'Blake,' i. p. 112 (1888).

Text-fig 59.



Sketch of distribution of the races of *Artibeus jamaicensis* in Mexico, C. America, the West Indies, and Northern S. America.
Dotted line: northern races (*parvipes, yucatanicus, jamaicensis, aequatorialis*). | Black line: southern races (*lituratus, palmarum, præceps*).
The name *præceps*, opposite Dominica and Guadeloupe, has been inadvertently omitted by the artist.